

F-22 Plus-Up Environmental Assessment

Joint Base Elmendorf-Richardson, Alaska



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14. ABSTRACT

This EA has been prepared in accordance with the National Environmental Policy Act (NEPA). The analysis focused on the following environmental resources: airspace management and air traffic control, noise, safety, air quality hazardous materials and waste management, biological resources, cultural resources, land use, socioeconomics, and environmental justice. Airspace management would not be impacted by the additional six primary F-22 aircraft. Additional portions of the Knik Arm, the Port of Anchorage, and land west of the Knik Arm would experience noise levels of 65 decibels (dB) Day-Night Average Sound Level (Ldn) or greater, but this change is not projected to significantly impact any human or natural resources, including threatened or endangered species. On February 22, 2011, the National Marine Fisheries Service evaluated the potential consequences and issued a finding of may affect but not likely to adversely affect Cook Inlet beluga whales. There would be no construction required. Hence, there would be no construction noise, no construction air emissions and no impacts to JBER cultural resources. Any hazardous materials associated with aircraft would be handled in the existing specialized F-22 maintenance facility and controlled to protect air and water resources. An increase of 103 base positions (less than one percent of base employment) is not expected to substantially affect commute times and would result in no measurable effect upon the regional economy. No on- or off-base residences are exposed to noise levels greater than 80 dB Ldn. Workers on JBER are protected against possible noise impacts by adherence to DoD noise management guidelines. The 65 dB Ldn noise contours would not extend off base over residential areas. Disadvantaged populations would not be disproportionately affected by the proposed plus-up, and there would be no health or safety impacts to children. The additional aircraft would not affect airspace management in existing Alaskan training airspace, including Special Use Airspace (SUA). The F-22 pilot's improved situational awareness and the F-22 normal training altitude are expected to result in no safety impacts to civil aviation. F-22 Class A mishap rates per 100,000 flight hours are expected to be comparable to those of the F-15. The increase in noise between baseline conditions and the Proposed Action would be 1 dB Ldnmr or less in all training airspaces. The additional F-22s would result in one to three additional sonic booms per month under approved training airspaces. This is not expected to affect special-status or game species, although Alaska Natives or others who reside or spend extensive time under the airspace could experience increased annoyance. Air quality, land use recreation, and cultural resources would not be affected by the additional six primary aircraft. Chaff and flare use and munitions training by the additional F-22s on approved ranges would be expected to

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F-22 Plus-Up Environmental Assessment

Joint Base Elmendorf-Richardson, Alaska

Our goal is to give you a reader-friendly document that provides an in-depth, accurate analysis of potential environmental consequences. The organization of this Environmental Assessment, or EA, is shown below:

Executive Summary

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How to Use This Document

This Environmental Assessment (EA) is prepared to help the reader understand the environmental consequences of the Proposed Action to plus-up the two F-22 squadrons at JBER-Elmendorf. Chapter 1.0 and 2.0 present the purpose and details of the proposed beddown.

Chapter 3.0 explains the affected environment of the proposed F-22 plus-up at JBER and within the Alaskan training airspace. The No Action Alternative is also addressed.

Chapter 4.0 explains the environmental consequences of the proposed F-22 plus-up at JBER and training within the Alaskan training airspace. The No Action Alternative is also addressed.

Public, Alaska Native, and Agency comments are incorporated into this EA.

The box to the left summarizes the EA contents.

Acronyms and Abbreviations can be found on the inside back cover.

Cover Sheet
ENVIRONMENTAL ASSESSMENT (EA) FOR
THE F-22 PLUS-UP AT JOINT BASE ELMENDORF-RICHARDSON (JBER)

- a. *Responsible Agency:* United States Air Force (Air Force)
- b. *Proposals and Actions:* This EA analyzes the potential environmental consequences of a proposal to plus-up the existing F-22 operational wing at JBER with six primary and one backup aircraft. In 2007, following the 2006 decision to beddown the second F-22 operational wing at Elmendorf AFB, 42 of the 60 F-15 primary aircraft assigned to then Elmendorf AFB were replaced by 36 F-22 primary and four backup aircraft. Subsequently, the remaining F-15C squadron of 18 primary aircraft was reassigned from Elmendorf AFB, leaving what is now JBER with 36 F-22 primary aircraft. The Proposed Action is to beddown six additional primary and one backup F-22 aircraft; conduct flying sorties at the base with F-22s operating with approximately 25 percent of departures from the cross-wind runway; train in existing Alaskan airspace; and implement personnel changes to conform to the F-22 Wing requirements. The additional F-22s would result in two squadrons each with 21 primary and two backup F-22 aircraft, and one attrition reserve aircraft, for a total of 47 F-22 aircraft. Personnel changes associated with the F-22 plus-up would result in an increase of 103 positions at the base. F-22 training flights would take place on existing Alaskan Military Operations Areas (MOAs), Air Traffic Control Assigned Airspace (ATCAAs), and ranges. During training, F-22s would continue to train at supersonic speeds, employ defensive chaff and flare countermeasures in airspace authorized for their use, and deploy munitions on approved ranges. The No Action Alternative would not locate additional F-22s at JBER at this time.
- c. *For Additional Information:* 673d Air Base Wing Public Affairs, Environmental Community Affairs Coordinator, 10480 22nd St., Ste. 118, JBER AK, 99506. Telephone inquiries may be made to 907-552-5756.
- d. *Designation:* Environmental Assessment (April 2011 draft).
- e. *Abstract:* This EA has been prepared in accordance with the National Environmental Policy Act (NEPA). The analysis focused on the following environmental resources: airspace management and air traffic control, noise, safety, air quality, hazardous materials and waste management, biological resources, cultural resources, land use, socioeconomics, and environmental justice.

Airspace management would not be impacted by the additional six primary F-22 aircraft. Additional portions of the Knik Arm, the Port of Anchorage, and land west of the Knik Arm would experience noise levels of 65 decibels (dB) Day-Night Average Sound Level (L_{dn}) or greater, but this change is not projected to significantly impact any human or natural resources, including threatened or endangered species. On February 22, 2011, the National Marine Fisheries Service evaluated the potential consequences and issued a finding of may affect but not likely to adversely affect Cook Inlet beluga whales. There would be no construction required. Hence, there would be no construction noise, no construction air emissions and no impacts to JBER cultural resources. Any hazardous materials associated with aircraft would be handled in the existing specialized F-22 maintenance facility and controlled to protect air and water resources. An increase of 103 base positions (less than one percent of base employment) is not expected to substantially affect commute times and would result in no measurable effect upon the regional economy. No on- or off-base residences are exposed to noise levels greater than 80 dB L_{dn} . Workers on JBER are protected against possible noise impacts by adherence to DoD noise management guidelines. The 65 dB L_{dn} noise contours would not extend off base over residential areas. Disadvantaged populations would not be disproportionately affected by the proposed plus-up, and there would be no health or safety impacts to children.

The additional aircraft would not affect airspace management in existing Alaskan training airspace, including Special Use Airspace (SUA). The F-22 pilot's improved situational awareness and the F-22 normal training altitude are expected to result in no safety impacts to civil aviation. F-22 Class A mishap rates per 100,000 flight hours are expected to be comparable to those of the F-15. The increase in noise between baseline conditions and the Proposed Action would be 1 dB L_{dnmr} or less in all training airspaces. The additional F-22s would result in one to three additional sonic booms per month under approved training airspaces. This is not expected to affect special-status or game species, although Alaska Natives or others who reside or spend extensive time under the airspace could experience increased annoyance. Air quality, land use, recreation, and cultural resources would not be affected by the additional six primary aircraft. Chaff and flare use and munitions training by the additional F-22s on approved ranges would be expected to increase proportionate to the additional F-22 training, or approximately 16.7 percent from existing F-22 use. No safety or biological consequences from continued chaff and flare or munitions use are anticipated.

With the previous departure of the three F-15 squadrons from JBER, No Action would affect the Air Force consolidation of F-22 aircraft to maximize aircraft for contingencies and would affect the enhancement of F-22 operational flexibility.

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FINDING OF NO SIGNIFICANT IMPACT

NAME OF PROPOSED ACTION. F-22 Plus-Up at Joint Base Elmendorf-Richardson (JBER), Alaska.

DESCRIPTION OF THE PROPOSED ACTION AND NO ACTION ALTERNATIVES. The United States Air Force (Air Force) proposes to plus-up the existing F-22 operational wing at JBER to consolidate F-22 aircraft, maximize aircraft for contingencies, and enhance F-22 operational flexibility. The Proposed Action is to beddown six primary and one backup F-22 aircraft; conduct flying sorties at the base with approximately 25 percent of all F-22 departures using the cross-wind runway; train as currently based F-22s do in existing Alaskan airspace; and implement personnel changes to conform to the F-22 Wing requirements. The additional F-22s would result in two squadrons each with 21 primary and 2 backup F-22 aircraft, and one attrition reserve aircraft, for a total of 47 F-22 aircraft. Personnel changes associated with the F-22 plus-up would result in an increase of 103 positions at the base. F-22 training flights would take place on existing Alaskan Military Operations Areas (MOAs), Air Traffic Control Assigned Airspace (ATCAAs), and ranges. During training, F-22s would continue to train at supersonic speeds, employ defensive chaff and flare countermeasures in airspace authorized for their use, and deploy munitions on approved ranges.

The No Action Alternative would not locate additional F-22s at JBER at this time. Based on the previous departure of three F-15 squadrons from JBER, No Action would affect the Air Force consolidation of F-22 aircraft to maximize aircraft for contingencies and would affect the enhancement of F-22 operational flexibility.

SUMMARY OF ENVIRONMENTAL CONSEQUENCES. The Environmental Assessment (EA) addresses the potential environmental consequences from implementing the Proposed Action and includes the No Action Alternative. The following resource areas were identified for assessment of potential direct or indirect environmental consequences: airspace management and air traffic control (including airport traffic), noise, safety, air quality, hazardous materials and waste management, biological resources, cultural resources, land use, socioeconomics, and environmental justice. Potential cumulative effects for each relevant resource are also presented.


The EA demonstrates that the proposed F-22 plus-up would not result in significant environmental impacts to any environmental resource area. Potential environmental consequences may be summarized as follows. Under the Proposed Action, airspace management would not be impacted by the additional six primary F-22 aircraft. An estimated additional 6.6 acres over the Port of Anchorage, 410.7 acres over water of the Knik Arm, and 0.2 acre of land west of the Knik Arm would experience noise levels of 65 decibels (dB) Day-Night Average Sound Level (L_{dn}) or greater. No on- or off-base residences are exposed to noise levels greater than 80 dB L_{dn} . Workers on JBER are protected against possible noise impacts by adherence to DoD noise management guidelines. Noise is not projected to significantly impact any human or natural resources. On February 22, 2011, the National Marine Fisheries Service (NMFS) completed evaluation of the potential consequences and issued a finding of may affect but not likely to adversely affect Cook Inlet beluga whales (NMFS 2010). There would be no significant impact upon threatened and endangered species. No public comments were received during the public review period indicating any concern or potential impact.

The F-22 estimated Class A mishap rate after eight years is almost identical to the F-15 mishap rate of 6.35 per 100,000 flight hours after eight years. The F-22 is expected to have the same long-term mishap rate of 2.46 per 100,000 flight hours as the F-15.

There would be no construction required. Hence, there would be no construction noise, no construction air emissions and no impacts to JBER cultural resources. Any hazardous materials, such as those associated with aircraft coatings, will be handled in the existing specialized F-22 maintenance facility and controlled to protect air and water resources. An increase of 103 base positions (less than one percent of base employment) is not expected to substantially affect commute times, and would result in no measurable effect upon the regional economy. The 65 dB L_{dn} noise contours would not extend off-base over residential areas. Disadvantaged populations would not be disproportionately affected by the proposed plus-up, and there would be no health or safety risks to children.

Potential consequences associated with the flight activities of the proposed additional F-22s in existing Alaskan Special Use Airspace (SUA) may be summarized as follows. The additional aircraft would not affect regional airspace management, and the F-22 pilot's improved situational awareness and the F-22 normal training altitude is expected to result in no safety impacts to civil aviation within the airspace. The increase in noise between baseline conditions and the Proposed Action would be 1 dB Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}) or less in all training airspaces. The additional F-22s would result in one to three additional sonic booms per month under approved training airspaces. This is not expected to affect special-status or game species, although Alaska Natives or others who reside or spend extensive time under the airspace could experience increased annoyance. Air quality, land use, recreation, and cultural resources would not be affected by the additional six primary aircraft. Chaff and flare use in approved airspace and munitions training on approved ranges would be expected to increase proportionate to the additional F-22 training, or approximately 16.7 percent from existing F-22 use. No safety or biological consequences from continued chaff, flare, or munitions use are anticipated.

CONCLUSION. Based on the findings of the EA conducted in accordance with the requirements of the National Environmental Policy Act, the Council on Environmental Quality regulations, and 32 CFR 989, *et seq.*, and after careful review of the potential impacts, I conclude that implementation of the Proposed Action would not result in significant impacts to the quality of the human or the natural environment. Therefore, a Finding of No Significant Impact is warranted, and an Environmental Impact Statement is not required for this action.



ROBERT D. EVANS
Colonel, USAF
Commander

22 June 2011
Date

F-22 Plus-Up Environmental Assessment

Joint Base Elmendorf-Richardson,
Alaska

June 2011

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EXECUTIVE SUMMARY

The United States (U.S.) Congress has approved the next-generation F-22 air dominance fighter to replace and supplement the increasingly vulnerable F-15C and F-15E aircraft fleets. In 2006 the United States Air Force (Air Force) relocated one squadron of F-15C and one squadron of F-15E aircraft from Elmendorf Air Force Base (AFB) and established the Second F-22 Operational Wing at what is now Joint Base Elmendorf-Richardson (JBER), Alaska. On July 29, 2010, the Department of the Air Force announced actions to consolidate the F-22 fleet by redistributing aircraft from Holloman AFB, New Mexico, to existing F-22 units, including the 3rd Wing (3 WG) at JBER. This Environmental Assessment (EA) analyzes the Air Force proposal to augment the F-22 Operational Wing at JBER by consolidating six primary and one backup F-22 aircraft to JBER from Holloman AFB.

The proposal is to plus-up the existing F-22 Operational Wing at JBER with six primary aircraft and one backup aircraft; conduct flying sorties at the base and in existing Alaskan airspace for training and deployment; and implement personnel changes to conform to the F-22 Wing requirements. The plus-up aircraft would result in two JBER squadrons, each with 21 primary and two backup F-22 aircraft, plus one attrition reserve aircraft, for a total of 47 F-22 aircraft.

F-22 training flights would continue to take place on Alaskan Military Operations Areas (MOAs), Air Traffic Control Assigned Airspace (ATCAA), and Restricted Areas (R-). During training, F-22s would continue to employ defensive chaff and flare countermeasures in airspace authorized for their use and deploy munitions on approved ranges under Restricted Airspace.

This EA and Finding of No Significant Impact (FONSI) have been prepared in accordance with the National Environmental Policy Act (NEPA) and its implementing regulations. This EA and draft FONSI were issued for a 30-day public and agency review and comment period. Comments on the EA and draft FONSI, in addition to the EA analyses, were considered in decision-making regarding the F-22 plus-up proposal.

PURPOSE AND NEED

The F-22 is a 21st century fighter designed to replace and supplement F-15C and F-15E aircraft which can be targeted by enemy air defenses at increasingly greater distances. The F-22 has the low-visibility, speed, and maneuverability to overcome adversaries and ensure air dominance over any battlefield. In 2007, following the 2006 decision to beddown the second F-22 operational wing at Elmendorf AFB, 42 of the 60 F-15 primary aircraft assigned to then Elmendorf AFB were replaced by 36 F-22 primary and four backup aircraft. Subsequently, the remaining F-15C squadron of 18 primary aircraft was reassigned from Elmendorf AFB, leaving what is now JBER with 36 F-22 primary aircraft. The proposed beddown would add six primary aircraft and one backup aircraft to JBER to meet Air Force mission requirements. The purpose of augmenting the JBER F-22 operational wing is to locate more combat aircraft where they would be available for contingencies and enhance F-22 operational flexibility.

PROPOSED ACTION AND NO ACTION ALTERNATIVES

The Proposed Action is to augment the existing F-22 operational wing at JBER, composed of 36 primary and three backup aircraft, and one attrition reserve aircraft to result in two squadrons each with 21 primary and two backup F-22 aircraft, plus one attrition reserve aircraft, for a total of 47 F-22 aircraft. The additional F-22 aircraft would conduct operations at JBER comparable to the existing F-22 operations, with approximately 75 percent of the departures and all landings on the main runway and approximately 25 percent of departures on the cross-wind runway. The additional F-22 aircraft would train in existing Alaska training airspace and ranges comparable to training of existing F-22 aircraft. Augmentation of the existing F-22 operational wing at JBER is proposed to take place over a period of approximately one year. An additional 103 personnel would be added to JBER. No new buildings would be needed to support the additional aircraft.

The No Action Alternative would not beddown an additional six F-22 primary aircraft at JBER at this time. The consolidation of F-22 aircraft for contingencies and to enhance F-22 operational flexibility would not occur. Existing F-22 aircraft would continue to train at supersonic speeds and use defensive countermeasures in approved airspace and deploy munitions at approved ranges in Alaska.

ENVIRONMENTAL CONSEQUENCES

The focused analysis is on the following environmental resources: airspace management and air traffic control (including airport traffic), noise, safety, air quality, hazardous materials, biological resources, cultural resources, land use, socioeconomics, and environmental justice.

Please refer to Figure 2.1-1 for a map of JBER-Elmendorf and Figure 2.2-2 for a map of Alaskan airspace.

Airspace Management and Air Traffic Control

Base. The additional six primary F-22 aircraft would use the base runways and fly in the base environs as the existing F-22 aircraft do today. The Proposed Action would add an average of approximately five F-22 sorties per day to base operations. Anchorage Alaska Terminal Area (AATA) management of airspace regional would not be impacted by this increase.

Airspace. The additional six primary F-22 aircraft would use the same Alaska airspace currently used for F-22 training. The additional aircraft would not affect regional airspace management. The usage of the airspace would not change to the extent that civil aviation would be affected. The time spent at higher MOA and ATCAA altitudes by the F-22, should have minimal or no effect upon civil aviation, including general aviation that normally flies at lower altitudes.

Noise

Base. Noise in military airspace is quantified by metrics called the Day-Night Average Sound Level (L_{dn}) and the Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}). No on- or off-base residences are exposed to noise levels greater than 80 dB L_{dnmr} and, therefore, hearing loss risk for on- or off-installation residents is relatively low. Structures in the flightline

Executive Summary

exposed to noise at greater than 80 dB L_{dn} would increase slightly from 52 to 63. Workers on JBER are protected against possible noise impacts by adherence to DoD noise management guidelines.

Additional off-base areas expected to be within the 65 dB L_{dn} noise contour are 6.6 acres over the Port of Anchorage, 410.7 acres over water of the Knik Arm, and 0.2 acre of land west of the Knik Arm. The 65 dB L_{dn} noise contours would not extend into residential areas off-base. The increased noise areas are not projected to impact human or natural resources in the area. Noise effects on biological resources are described below under biology.

Airspace. No discernible difference in subsonic noise is projected in MOAs used for training. The change in L_{dnmr} between baseline conditions and the Proposed Action under MOAs used for training would be 1 dB or less. F-22 aircraft currently train at supersonic speed approximately 25 percent of a typical air-to-air engagement. The plus-up would result in a noticeable increase in sonic booms, from 18.1 to an estimated 21.5 per month under the Stony MOAs/ATCAAs. Other MOAs/ATCAAs approved for supersonic training would have increases in sonic booms from one to three per month depending on the airspace. Currently there are from 10 to 26 sonic booms per month under the approved MOAs/ATCAAs. Sonic booms would not pose a health or other risk but could increase annoyance.

Safety

Base. There would be no substantial change regarding airfield safety conditions, Bird-Aircraft Strike Hazard (BASH), munitions, or personnel safety. The number of aircraft at the base would be fewer than had been in 2006. JBER-Elmendorf aircraft ground safety would essentially remain the same with an F-22 plus-up.

The F-22 is a new aircraft which has an approximate Class A mishap rate after eight years of test and operations nearly identical to the twin-engine F-15 mishap rate of 6.35 per 100,000 flight hours after eight years of test and operations. As experience with the F-22 grows, the F-22 is expected to have approximately the same long-term Class A mishap rate of 2.46 per 100,000 flight hours as the F-15.

Explosive safety includes the management and use of ordnance or munitions associated with airbase operations and training activities. The amount of munitions associated with the two F-22 squadrons, with the plus-up, would be lower than munitions use of the historic F-15 squadrons. The use of chaff and flares would be below historic F-15 levels but would increase proportionally to the number of F-22s training in the airspace (an approximate 16.7 percent increase). JBER has the personnel and facilities to handle the proposed levels of munitions, chaff, and flares associated with the additional aircraft.

Airspace. Within the training airspace, aircraft safety and bird-aircraft strikes with the additional six primary F-22s would be proportioned to the 36 primary aircraft already assigned to the base. All safety actions that are in place for existing F-22 training would continue to be in place for the additional aircraft. The F-22 pilot's improved situational awareness and the F-22 normal training altitude is expected to result in no safety impacts to civil aviation within the airspace.

Additional F-22s training in the airspace would increase chaff or flare use proportionately (an estimated 16.7 percent) over baseline F-22 use. After deployment of each chaff bundle, four 1-inch by 1/2-inch plastic or nylon pieces and six 2-inch by 3-inch pieces of paper fall to the ground. After deployment of each flare, three plastic pieces of up to 2 inches by 2 inches and one 1-inch by 1-inch to 4-inch by 15-inch aluminum-coated duct tape-type mylar wrapping fall to the ground. These nylon, paper, or other pieces would not affect safety for human or biological resources under the airspace. No safety consequences from continued chaff and flare use are anticipated.

Air Quality

Base. The Anchorage area is in air quality attainment for all criteria pollutants and anticipated emission resulting from the Proposed Action would not cause or contribute to a new National Ambient Air Quality Standards (NAAQS) violation. No conformity determination is required as the emissions for all pollutants are below the de minimis threshold established by the U.S. Environmental Protection Agency (USEPA) in 40 Code of Federal Regulations (CFR) 93.153. Airfield flight operation emissions are projected to be minimally higher than at present, yet should result in no change in air quality within the Anchorage area. No additional global Green House Gases (GHG) would be emitted by transferring six F-22 aircraft from New Mexico to Alaska. Regional GHG would increase less than one percent of the regional military GHG emissions.

Airspace. Areas under the training airspace are within air quality attainment. Emissions from the increase above current F-22 operations would be transitory and dispersed over the extensive Alaskan Special Use Airspace (SUA). More than 99.5 percent of F-22 flight operations occur at altitudes above the mixing height of pollutants. Residents and visitors to Alaska Native villages and traditional subsistence areas underlying this airspace would not experience any change in emissions associated with the Proposed Action.

Hazardous Materials and Waste Management

Base. There would be no significant impacts on hazardous materials, hazardous wastes, or the Environmental Restoration Program (ERP). Existing procedures are adequate to handle the changes anticipated with the expected approximate 16.7 percent increase in use of F-22 hazardous materials associated with the plus-up.

Airspace. The F-22 plus-up would not substantially change airspace use or training. The F-22 does not discharge hazardous wastes in the Alaskan airspace. Various hazardous materials and fluids are contained in the aircraft but are not released in the training airspace. No significant impacts on hazardous materials or wastes in the training airspace are expected.

Biological Resources

Base. No impacts would occur to vegetation and no wildlife habitat would be lost within the base environs Region of Influence (ROI) at JBER-Elmendorf. Concerns for biological resources include potential impacts on threatened or endangered species, and noise associated with F-22 operations.

Executive Summary

Although there are no federally listed threatened or endangered species that inhabit JBER-Elmendorf, noise contours associated with the proposed increased operation of F-22s extend into the Knik Arm of Cook Inlet, where Cook Inlet beluga whales (CIBW) occur. Potential effects to the CIBW include behavioral response to the overflight of F-22s over the Knik Arm. Overflight patterns and noise contours were quantified over the Knik Arm. The quantifications demonstrate that approximately 0.04 individuals per year (four individuals in 100 years) would be expected to adjust behavior as a result of the noise generated by the proposed additional F-22 flying operations. On February 22, 2011, the National Marine Fisheries Service determined that this level of behavior response would mean the plus-up may affect but is unlikely to adversely affect the CIBW. On February 8, 2011, the USFWS indicated that no federally listed or proposed species and/or designated or proposed critical habitat for which the USFWS is responsible are within the action area of the project. The additional F-22 aircraft operating from JBER would not be expected to have a significant environmental effect upon any biological species, including listed or candidate species.

Airspace. No discernible difference in subsonic noise is projected in MOAs used for training. There would be no change in effects to wildlife. Increases in sonic booms under some airspace units may startle some individual animals, although wildlife under the training airspaces have previously experienced sonic booms and are likely habituated. An approximate 16.7 percent increase in F-22 chaff and flare use would not be expected to adversely impact biological resources.

Cultural Resources

Base. No new construction would be necessary to accommodate the F-22 plus-up. Thus, no direct impacts to cultural resources are anticipated. The personnel increase of less than one percent of the JBER population is not expected to result in any indirect impacts to cultural resources.

Airspace. There would be no impacts to historic properties under the airspace. The increase in sonic booms may be detected and could annoy some Alaska Native users of land but would not be expected to affect subsistence hunting or other activities.

Land Use, Transportation, and Recreation

Base. No changes in land use or transportation on base would be expected. There would be some extension of the 65 dB L_{dn} noise contour over a portion of the Knik Arm, and over compatible land uses in the Port of Anchorage area. The noise increase from additional F-22 operations should not result in changes to land use or land ownership. The 65 dB L_{dn} contour extending over an additional 0.2 acre of the Matanuska-Susitna Borough-owned peninsula tip across the Knik Arm is not projected to affect land uses in the area. Noise contours of 65 dB L_{dn} would not extend off-base into residential areas. There would be no changes to the safety zones.

A less than one percent increase in on-base employment could slightly increase vehicle trips in the long term. The negligible increase in traffic is not expected to substantially affect commute times.

Airspace. An increase in average sonic booms by an estimated one to three booms per month would occur under MOAs used for training. Alaska Natives who live under or spend extensive time subsistence hunting and fishing under these MOAs could discern the additional sonic booms. The increased frequency of sonic booms would not be expected to affect land use or land use patterns, ownership, or management, but the increase has the potential to cause additional annoyance to residents and long-term users of the lands under the affected airspace.

Socioeconomics

Base. The addition of 103 Air Force personnel to support the additional six F-22 primary aircraft represents less than one percent of JBER employment. The potential population, employment, income, and output associated with an addition of less than one percent of the personnel and no new construction would be expected to result in no measurable effect upon the regional economy. The Anchorage housing market with approximately 6,700 vacant units and a 6.0 percent vacancy rate would be expected to easily absorb the additional personnel.

Airspace. There would be no discernible effects on social or economic conditions under the airspace. The projected increase in sonic booms may annoy individuals participating in subsistence or recreational hunting or fishing. This would not be expected to significantly affect activities under the airspace or local economies that rely on subsistence resources. The Air Force has established procedures for any damage claims associated with sonic booms that begin by contacting the JBER Public Affairs Office.

Environmental Justice

Base. Federal agencies are required by law to address potential impacts of their actions on environmental and human health conditions in minority and low-income communities. Furthermore, they must identify and assess environmental health and safety risks that may disproportionately affect children. The low-income communities and the minority and youth population near JBER were evaluated. The off-base community of Mountain View has a concentration of minority and low-income population. The proportion and type of JBER flight operations from the main and cross-wind runways are performed to avoid the extension of 65 dB L_{dn} noise contours into the Mountain View community. No off-base significant noise impacts are expected to minority or low-income communities. There would be no health and safety risks to children.

Airspace. High proportions of Alaska Natives who live under the airspace are representative of rural populations throughout the state. Persons living under the airspace, particularly the Stony MOAs, could notice or be annoyed by increased sonic booms. This change in sonic booms by an additional one to three per month would not be expected to damage health or other environmental resources. No disproportionately high or adverse impacts to minority or low-income communities would result from increased F-22 training. There would be no health and safety risks to children.

Cumulative Consequences

Cumulative effects analysis considers the potential environmental consequences resulting from “the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such actions” (40 CFR 1508.7). Multiple federal and non-federal projects near the base and airspace were identified and evaluated to see whether cumulative impacts could occur.

Base. The relocation of three F-15 aircraft squadrons, the beddown of C-17 aircraft, Base Realignment and Closure (BRAC) decisions regarding C-130 aircraft, proposed transportation projects, and other projects were cumulatively evaluated. As JBER combines administrative, air, and ground activities over the next few years, there could be a desire to assess such combined efforts in a future environmental analysis. Such a future analysis, should it occur, would include all JBER activities and would not be connected to the F-22 plus-up. The F-22 plus-up would not be expected to have adverse cumulative effects in combination with past, present, or reasonably foreseeable cumulative actions.

Airspace. The airspace analysis in this EA includes all expected aircraft operations in existing Alaska training airspace. Potential airspace enhancements to the Joint Pacific-Alaskan Range Complex (JPARC) are currently under study. Any potential JPARC impacts to airspace management will be addressed in separate environmental documentation. The cumulative replacement of three squadrons operating a total of 60 primary twin-engine fighter aircraft with 42 (36 plus 6) similarly-sized twin-engine fighter aircraft would not be expected to have an adverse cumulative effect in combination with past, present, or reasonably foreseeable cumulative actions.

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1.0 PURPOSE AND NEED FOR F-22 PLUS-UP AT JBER

In 1985, Congress determined that a need existed to provide the United States Air Force (USAF) with a next-generation fighter to replace and supplement the aging F-15C and newer F-15E fleet, and to ensure air dominance well into the 21st century. Congress determined that the F-22 would meet this need. In 2006 the Air Force selected what is now Joint Base Elmendorf-Richardson (JBER), Alaska as the location for the second F-22 operational wing (*F-22 Beddown Environmental Assessment [EA], Elmendorf, Alaska, and Finding of No Significant Impact [FONSI]*, 2006). Figure 1.0-1 illustrates the airfield area.

On July 29, 2010, the Department of the Air Force announced proposed actions to consolidate the F-22 fleet. The Secretary of the Air Force and the Chief of Staff of the Air Force determined that the most effective basing for the F-22 requires redistributing aircraft from an F-22 squadron at Holloman Air Force Base (AFB), New Mexico to existing F-22 units at JBER, Langley AFB (Virginia), and Nellis AFB (Nevada). A second F-22 squadron at Holloman AFB would be relocated to Tyndall AFB (Florida), also an existing F-22 base.

The purpose of the proposed F-22 plus-up at JBER is to consolidate F-22 aircraft to maximize combat aircraft and squadrons available for contingencies, and enhance F-22 operational flexibility (Air Force 2010a). The F-22 plus-up at JBER is needed for improved combat effectiveness of existing F-22 operational squadrons.

1.1 Background

The F-22 is a 21st century fighter designed to replace and supplement F-15C and F-15E aircraft, both of which can be targeted by enemy air defenses at increasingly greater distances. The F-22 has the low visibility, speed, and maneuverability to overcome adversaries and ensure air dominance over any battlefield. The purpose of augmenting the JBER F-22 operational wing is to locate more of these advanced assets in the westernmost United States.



JBER is home to the second operational wing of F-22 fighter aircraft.



The Proposed Action is to plus-up the F-22 squadrons in Alaska by adding seven aircraft to the F-22 operational wing.

In 2006, the Air Force completed an EA and FONSI for the beddown of 36 primary aircraft F-22s at Elmendorf AFB (Air Force 2006). In 2007, 36 of the 54 F-15 primary aircraft plus six backup aircraft assigned to Elmendorf AFB were replaced by 36 F-22 primary aircraft and four F-22 backup aircraft. Subsequently, the remaining F-15C primary aircraft were reassigned from Elmendorf AFB, leaving only the 36 F-22 primary aircraft. The proposed plus-up would add six additional primary aircraft and one backup aircraft to JBER to meet Air Force mission requirements.

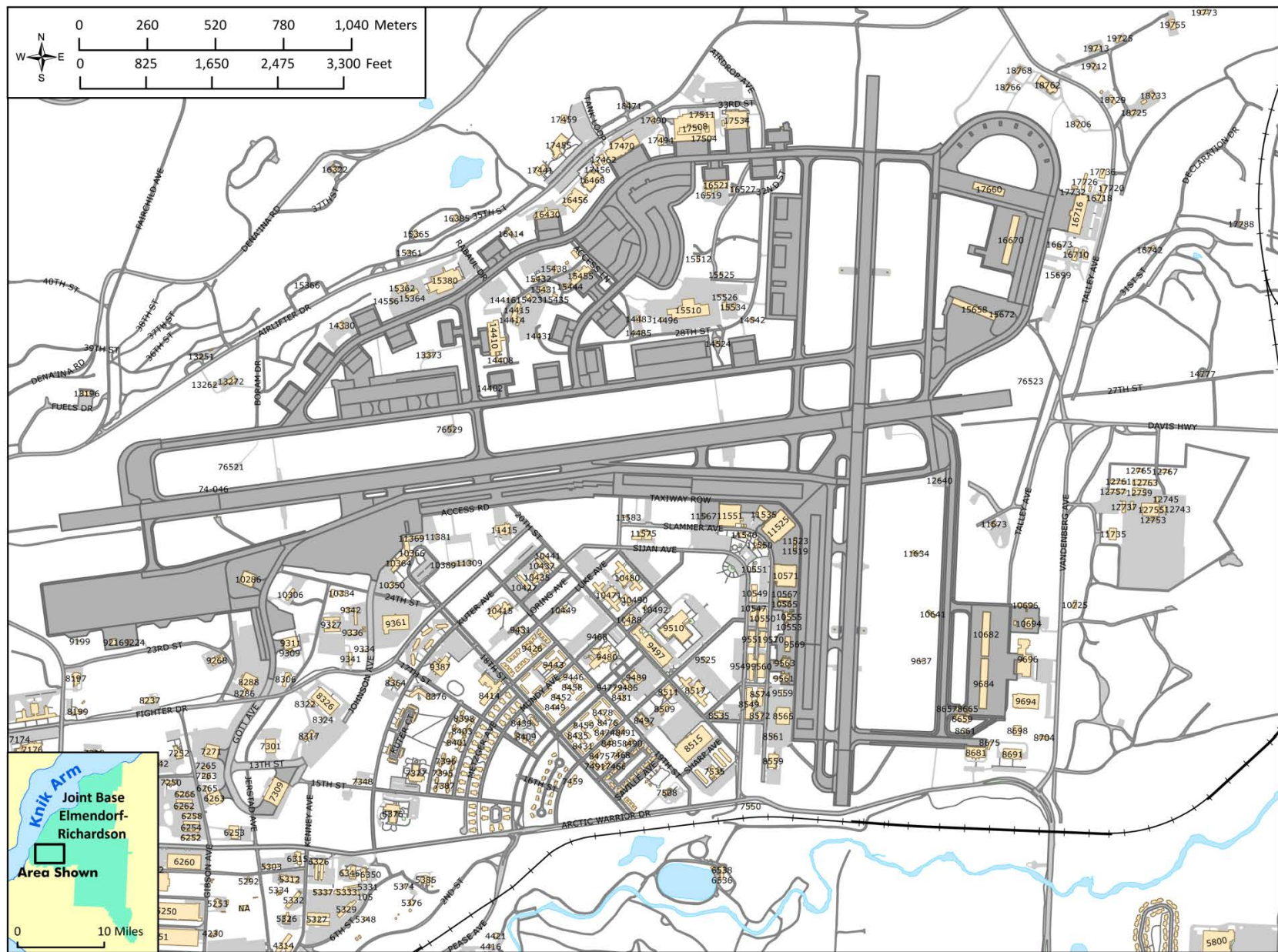


Figure 1.0-1. Airfield Area of Joint Base Elmendorf-Richardson Referred to in this EA

1.0 Purpose and Need for F-22 Plus-Up at JBER

The proposal is to beddown six primary and one back up F-22 aircraft, conduct flying sorties at the base for training and deployment, and implement personnel changes to conform to the F-22 Wing requirements. Primary aircraft are aircraft authorized to a unit for performance of its operational mission. The primary authorization forms the basis for the allocation of operating resources to include manpower, support equipment, and flying-hour funds. Backup aircraft are aircraft assigned to a base to support the operational mission when a primary aircraft is unavailable to fly for any reason. Attrition reserve aircraft serve to replace any aircraft lost through Class A mishaps.

Training flights of the additional F-22 aircraft would take place in Alaskan Military Operations Areas (MOAs), Air Traffic Control Assigned Airspace (ATCAA), and Restricted Areas where F-22 aircraft currently train at subsonic and supersonic speeds (Figure 1.1-1).

During training, F-22s employ defensive chaff and flare countermeasures in airspace authorized for their use. Air-to-ground munitions continue to be deployed by F-22 fighters on approved ranges.

This EA addresses the potential environmental consequences associated with the F-22 Plus-Up, according to the requirements of the National Environmental Policy Act (NEPA) (42 United States Code [U.S.C.] 4321 et seq.), Council on Environmental Quality (CEQ) regulations (40 Code of Federal Regulations [CFR] 1500-1508), and The Environmental Impact Analysis Process (32 CFR 989 et seq.). NEPA is the basic national charter for identifying environmental consequences of major federal actions. NEPA ensures that environmental information is available to the public, agencies, and decision makers before decisions are made and actions are taken.

The F-22 Raptors based at JBER are designed to ensure that America's armed forces retain air dominance. This means complete control of the airspace over an area of conflict, thereby allowing freedom to attack and freedom from attack at all times and places within the full spectrum of military operations. Air dominance provides the ability to defend American and Allied forces from enemy attack, and to attack air and ground adversary forces without hindrance from enemy aircraft. During the initial phases of deployment into an area of conflict, the first aircraft to arrive are the most vulnerable because they face the entire warfighting capability of an adversary. The F-22's state-of-the-art technology, advanced tactics, and skilled aircrew will ensure air dominance from the outset of such situations. The F-22 has the low-visibility, speed, and maneuverability to overcome adversary improvements in air defenses, and ensure air dominance over any battlefield.



1.1.1 *Aircraft Characteristics of the F-22*

The F-22 has enhanced low visibility, speed, maneuverability, electronics, and maintainability.

The F-22 Raptor is a single-seat, all-weather, multipurpose fighter capable of both air-to-air and air-to-ground missions. Powered by two 35,000-pound thrust-class engines, the F-22 routinely operates at high altitudes (above 30,000 feet mean sea level [MSL]). The F-22 can achieve speeds needed for air-to-air combat while using relatively low power settings. F-22 characteristics make the aircraft able to launch sophisticated weapons at high speeds and from greater distances than possible with other aircraft. The F-22 is approximately 62 feet long, with a wingspan of 44 feet, and a height of more than 16 feet.

F-22 Plus-Up Environmental Assessment
1.0 Purpose and Need for F-22 Plus-Up at JBER

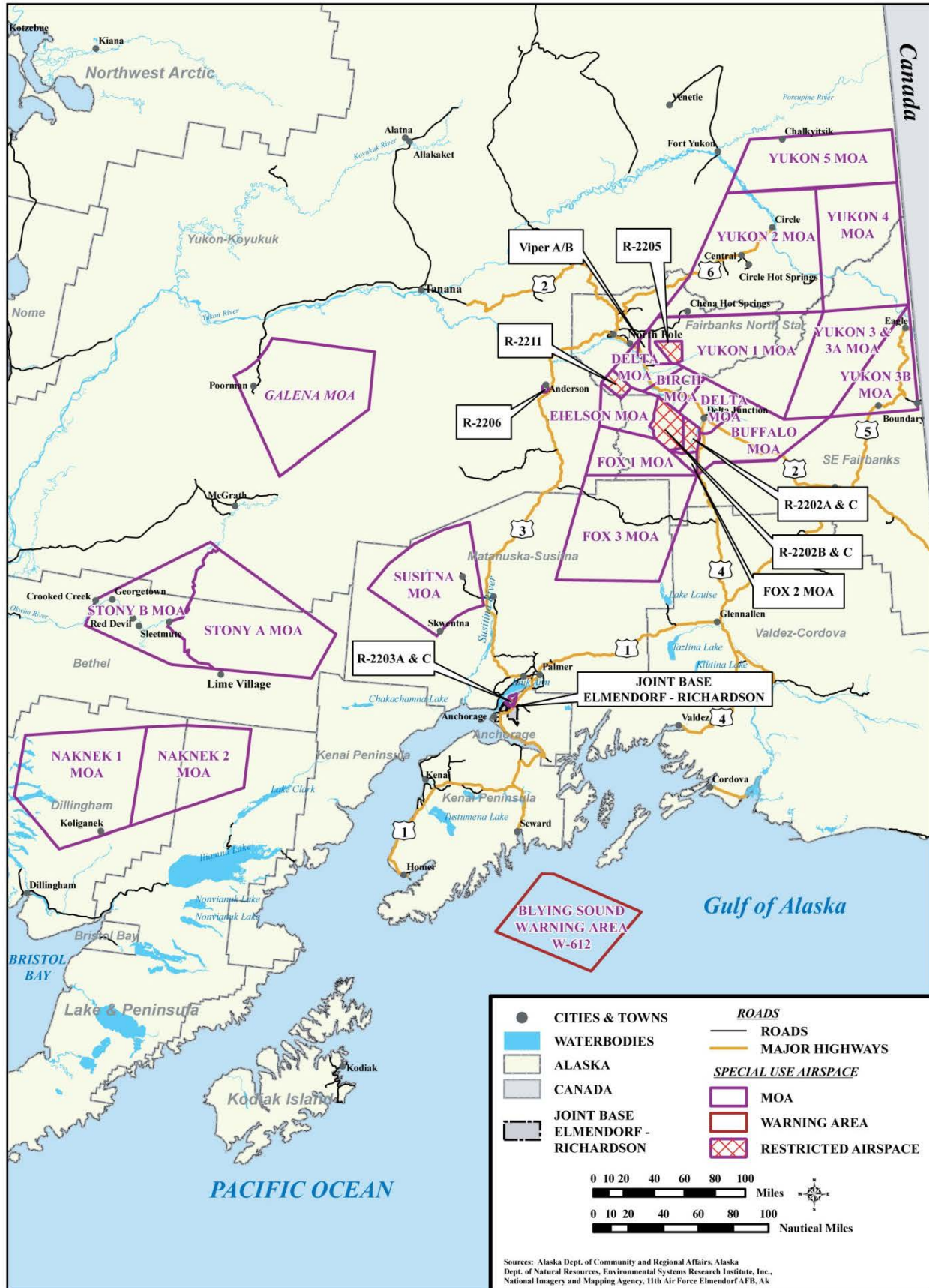


Figure 1.1-1. Training Special Use Airspace

1.0 Purpose and Need for F-22 Plus-Up at JBER

JBER F-22 aircraft can carry air-to-air missiles and a variety of conventional and Long Range Standoff Weapons (LRSOW) for air-to-ground ordnance delivery. The F-22 has a 20-millimeter multi-barrel cannon. Training in Alaskan airspace simulates air-to-air missiles by aircraft exercising all aspects of the weapon system without actually launching an air-to-air missile. Air-to-ground training with LRSOW would include flying to launch profiles and speeds at high altitude with simulated launches. Existing Alaska conventional ranges would be used for munitions training. Release profiles, altitudes, and speeds are now, and would continue to be, limited to keep weapon safety footprints within established Alaskan ranges.

1.1.2 Joint Base Elmendorf-Richardson (JBER)

JBER, located near Anchorage, Alaska, is the home of the Air Force's Alaskan Command, 11th Air Force, Alaskan North American Air Defense region, and the 673d Air Base Wing, as well as U.S. Army Alaska. The F-22 3rd Wing (3 WG) is comprised of two squadrons of F-22s (36 primary aircraft). JBER also is home to C-17 transports, C-12 and E-3 aircraft, and CH-47 Chinook and UH-60 Blackhawk helicopters, all of which have been regularly deployed to combat areas. JBER covers 84,000 acres, including a 10,000-foot main runway and a 7,500-foot cross-runway. Figure 1.0-1 presents JBER's airfield and operational area; the airfield and operational area is referred to as JBER-Elmendorf. The Proposed Action would include 103 additional personnel to support the additional F-22 aircraft.



JBER has had multiple squadrons at different times during its history.

JBER has extensive airspace for training (Figure 1.1-1), including overland MOAs and ATCAAs which provide regular training airspace for the F-22s, other aircraft, and larger two-week scheduled Major Flying Exercises (MFEs). Many of these airspaces permit supersonic flight and allow the use of chaff and flares for defensive training. Existing Army Training Ranges provide for local air-to-ground training for F-22 aircraft. No airspace modifications are proposed for the additional F-22 aircraft; Chapter 2.0 of this EA describes the F-22 missions and training.

1.2 Purpose of F-22 Plus-Up at JBER

The purpose of the proposed plus-up of F-22 aircraft at JBER is to provide additional Air Force capabilities at a strategic location to meet mission responsibilities for worldwide deployment. This consolidation of F-22 operational aircraft would be designed to maximize combat aircraft and squadrons available for contingencies. The plus-up of six F-22 primary aircraft and one backup aircraft would fill out the existing JBER F-22 squadrons and provide enhanced capabilities while efficiently using JBER facilities designed and constructed for the existing F-22 operational wing.

1.3 Need for the F-22 Plus-Up at JBER

Two squadrons of F-15C air superiority aircraft and one squadron of F-15E air-to-ground aircraft were relocated from JBER between 2005 and 2010. Since World War II, JBER has provided an advanced location on U.S. soil for projection of U.S. global interests. Additional F-22 aircraft are needed at JBER to provide expanded U.S. Air Force capability to respond efficiently to national objectives, be available for contingencies, and enhance F-22 operational flexibility.



JBER capabilities with multi-role F-22 operational squadrons would be enhanced by the addition of six operational F-22 aircraft.

2.0 DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

The Proposed Action is to augment the existing F-22 operational wing at JBER with six primary aircraft and one backup aircraft. This chapter describes the Proposed Action and the No Action Alternative. The No Action Alternative would not beddown the additional F-22 aircraft at JBER at this time.

Augmentation of the existing F-22 operational wing at JBER is proposed to take place over a period of approximately one year. An additional 103 personnel would be added to JBER. No new buildings would be needed to support the aircraft. Training would occur in existing Alaska military use airspace.



The existing F-22 operational wing capabilities at JBER would be enhanced by the additional aircraft.

The existing F-22 operational wing at JBER consists of two squadrons of 18 primary aircraft each, plus a total of three backup aircraft. With the proposed plus-up, each of the two F-22 squadrons at JBER would be composed of 21 primary aircraft plus two backup aircraft. The two-squadron F-22 operational wing would include 42 primary aircraft, four backup aircraft, and one attrition reserve aircraft for a total of 47 aircraft. Primary aircraft consists of the aircraft authorized and assigned to perform the squadron's missions in training, deployment, and combat. Backup aircraft are additional aircraft that are used as substitutes for primary aircraft during, for example, scheduled and unscheduled maintenance and modifications. Attrition reserve aircraft serve to replace any aircraft lost through Class A mishaps.

Activities Affecting JBER

- Beddown six additional primary and one backup F-22 aircraft over a period of approximately one year.
- Conduct flying sorties at the base for training and deployment.
- Implement the personnel changes at the base to conform to the expanded F-22 wing's requirements.

Elements Affecting Alaskan Airspace

- Conduct subsonic and supersonic F-22 training flights in MOAs, Air Traffic Control Assigned Airspace (ATCAA), and Restricted Areas.
- Employ defensive countermeasures (chaff and flares) in airspace authorized for their use.
- Train for air-to-air and air-to-ground missions.

The Base Realignment and Closure (BRAC) Act of 2005 directed that one of the two squadrons of F-15C aircraft and the single F-15E squadron be relocated from what is now JBER. This relocation was completed in 2007. Subsequent to the BRAC action, the remaining squadron of F-15C aircraft was relocated from Elmendorf AFB by September 2010. The plus-up of six primary F-22 aircraft to the existing operational wing would retain Air Force mission capabilities at JBER.

The proposed plus-up of the F-22 operational wing would involve activities at the base and in the associated training airspace. This chapter presents

proposed activities at the base, training use of Special Use Airspace (SUA) and other training airspace, use of air-to-ground ranges, and personnel associated with a plus-up of six primary F-22 aircraft at JBER. The No Action Alternative is described in conformance with the CEQ regulations [40 CFR 1502.14(d)] in Section 2.4.

2.1 Proposed Action Elements Affecting JBER-Elmendorf

JBER is used in this EA to refer to the entire Joint Base Elmendorf-Richardson. JBER-Elmendorf refers to the F-22 activities and operations at, and in the vicinity of, the airfield. The proposed plus-up of the F-22 operational wing at JBER-Elmendorf could affect two aspects of the base:

1. The beddown and flight activity of six primary aircraft could affect the base and its environs. This section describes existing and proposed flight activities near the base.
2. The beddown would affect the numbers and responsibilities of base personnel. The proposed personnel change is described in this section.

2.1.1 JBER-Elmendorf Flight Activities

The additional six F-22 primary aircraft would use the base runways, and fly in the base environs, similarly to how the existing 36 F-22 aircraft do currently. This includes take-off and landings, training, and deployment.

The Air Force anticipates that, by completion of the plus-up beddown, the JBER F-22 operational wing would fly approximately 5,210 sorties per year from JBER-Elmendorf. The Air Force would continue occasional use of other Alaskan locations at the same levels currently used by F-22 training aircraft.

A sortie is the flight of a single aircraft from takeoff to landing.

JBER F-22s would continue to fly the same percentage (30 percent) of sorties after dark (i.e., about one hour after sunset) as required under the Air Force's initiative to increase readiness. Aircrews operating from JBER-Elmendorf can normally fulfill the annual night flying requirements during winter months without flying after 10:00 p.m. or before 7:00 a.m. to be consistent with the JBER-Elmendorf noise abatement program.

The drawdown of the third F-15C squadron has reduced total fighter aircraft based at JBER-Elmendorf by 24 primary aircraft. The proposed addition of six F-22 primary aircraft would partially backfill the number of aircraft assigned to JBER. The F-22 operational wing at JBER-Elmendorf would be comprised of two squadrons of 21 primary aircraft each. The number of F-22 sorties would be as described above.



Due to long hours of darkness during the winter months, aircrews operating from JBER can fulfill night-flying requirements without flying during environmental night (after 10:00 p.m. to 7:00 a.m.).

Table 2.1-1 presents the type and number of fixed-wing aircraft currently assigned to and proposed for JBER-Elmendorf. Additional aircraft assigned to JBER include helicopters. This table permits a comparison of current aircraft assignments and proposed F-22 beddown assignments.

JBER-Elmendorf flight operations occur on the main runway (06/24) and the cross-wind runway (16/34). The existing and plus-up F-22 operations would consist of approximately 25 percent of departures on Runway 16/34 and all landings and second approaches on Runway 06/24. The main runway would be the primary runway used by F-22 and other JBER-based

2.0 Description of the Proposed Action and Alternatives

and transient aircraft except in the case of national emergencies, major flying exercises, runway or taxiway maintenance, or limited programs to evaluate alternative flight operations. Other than in these cases, F-22 launches, existing and projected with the plus-up, would be approximately 25 percent on Runway 34 (northbound crosswind) and no launches would be expected to occur on Runway 16 (southbound crosswind). Figure 2.1-1 identifies the runways. F-22 landings would continue to occur almost exclusively on Runway 06/24. C-17 flight operations will continue to use primarily Runway 06/24 with limited use of Runway 16/34. Many of the C-17 approaches to Runway 16 are not followed by a departure from Runway 16 to complete a standard closed pattern. Rather, these approaches are often followed by a departure from Runway 06/24 and then maneuvering for another approach to Runway 16.

Table 2.1-1. Baseline and Proposed Primary Aircraft Assigned to JBER-Elmendorf

<i>Aircraft Type</i>	<i>Number Assigned</i>	
	Baseline	Proposed
F-22	36	42
C-17	8	8
C-130	16	16
C-12	2	2
E-3A	2	2

JBER-Elmendorf also supports a range of transient users. On an annual basis, the installation has supported the levels of aviation operations shown in Table 2.1-2. An operation can be a take-off or departure, a landing or arrival, or a touch-and-go within a closed pattern around the airfield.

Table 2.1-2. JBER-Elmendorf Airfield Annual Operations

<i>Fiscal Year (FY)</i>	<i>Number of Operations</i>
2005	41,340
2006	59,567
2007	42,346
2008	40,354
2009	44,561
2010	47,315

Operations conducted in recent years have been affected by many factors, including beddown of C-17 and C-130 aircraft, drawdown of F-15C aircraft, and frequent deployment of assigned units overseas. While annual traffic has been highly variable, annual operations conducted in fiscal years (FYs) 2009 and 2010 provide an approximation of the installation's expected annual demand.

2.1.2 JBER-Elmendorf Facilities

Facilities constructed for the initial F-22 operational wing beddown (Figure 2.1-1) would be able to accommodate the proposed additional six primary and one backup F-22 aircraft. Thus, no new construction would be necessary.



JBER existing weather shelters, Hangar 15, and other facilities provide adequate space for the F-22 plus-up without the need for new buildings.

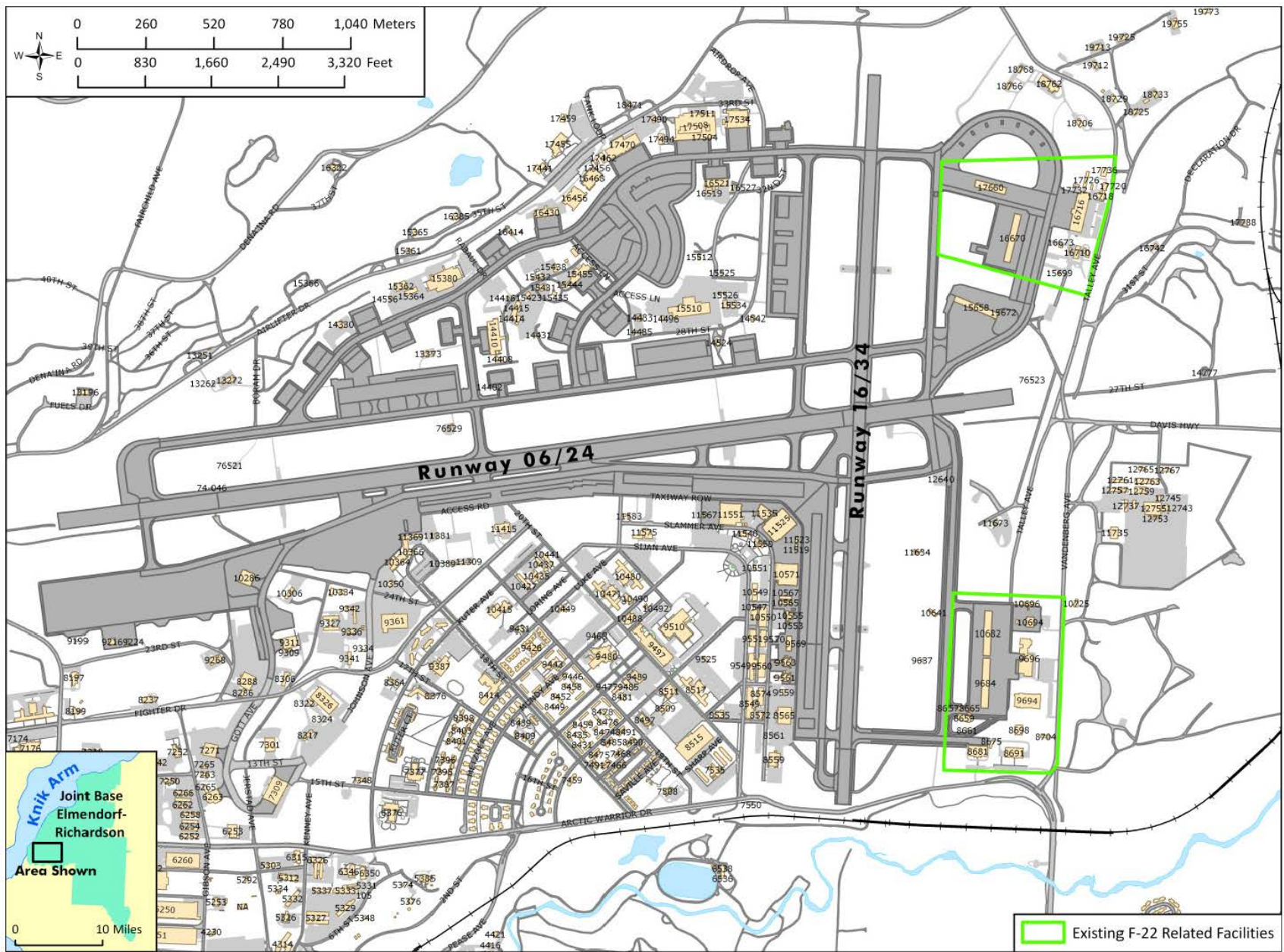


Figure 2.1-1. Location of F-22 Facilities

2.0 Description of the Proposed Action and Alternatives

2.1.3 JBER-Elmendorf Personnel

The addition of six primary and one backup F-22 aircraft at JBER-Elmendorf would require additional personnel to operate and maintain the aircraft and to provide necessary support services. F-22 personnel would increase by an estimated 103 positions from the personnel numbers associated with the current F-22 squadrons. Table 2.1-3 details the manpower requirements to support the plus-up of the F-22 wing.



Multiple personnel and skills are needed to support F-22 operational aircraft.

Table 2.1-3. Manpower Requirements

	<i>Manpower Requirements</i>			
	Officer	Enlisted	Civilian	Total
F-22 ¹	92	661	193	946
F-22 ²	102	734	213	1,049

Notes:

1. Existing two squadrons of 18 primary aircraft.
2. Requirements for two squadrons of 21 primary aircraft.

2.2 Proposed Action Elements Affecting Alaskan Airspace

F-22s at JBER-Elmendorf conduct similar missions and training programs as performed with the F-15Cs and F-15Es previously located at what is now JBER. The Air Force expects that the additional F-22s would use the training airspace associated with JBER in a manner similar to the F-22s currently based there. All F-22 flight activities would use existing Alaskan airspace.

Figure 2.2-1 displays the five types of Alaskan training airspace. Four of those airspace types are used by F-22 aircraft for training. Airspace managed by JBER associated with the proposed F-22 plus-up includes MOAs, ATCAAs, Warning Areas, and Restricted Areas. Restricted Areas and the ground ranges supporting air-to-ground training are provided by joint use ranges at Stuart Creek Range (R-2205) and the Oklahoma Impact Area of R-2202 (Figures 2.2-2 and 2.2-3). The Army's Blair Lakes Range (R-2211) is exclusively used by the Air Force.

Operational requirements and performance characteristics of the F-22 dictate that most training would occur in MOAs and ATCAAs. MOAs are established by the Federal Aviation Administration (FAA) to separate military training aircraft from non-participating aircraft (those not using the MOA for training). Nonparticipating military and civil aircraft flying under visual flight rules may transit an active MOA by employing see-and-avoid procedures. When flying under instrument rules, nonparticipating aircraft must obtain an air traffic control clearance to enter an active MOA.



The additional F-22 aircraft would train in existing Alaskan airspace where the two squadrons of JBER F-22 aircraft now train.

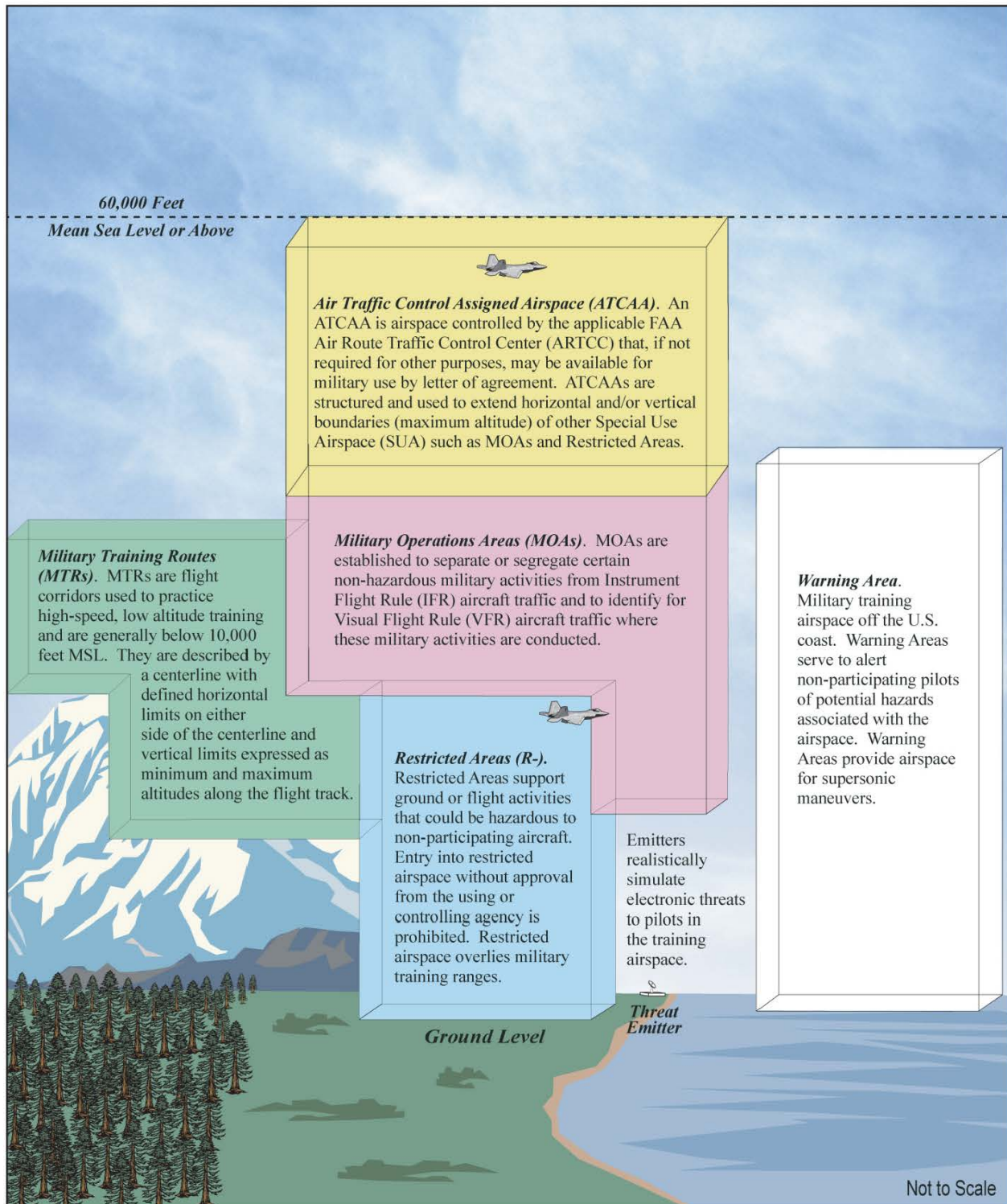


Figure 2.2-1. Types of Training Airspace

2.0 Description of the Proposed Action and Alternatives

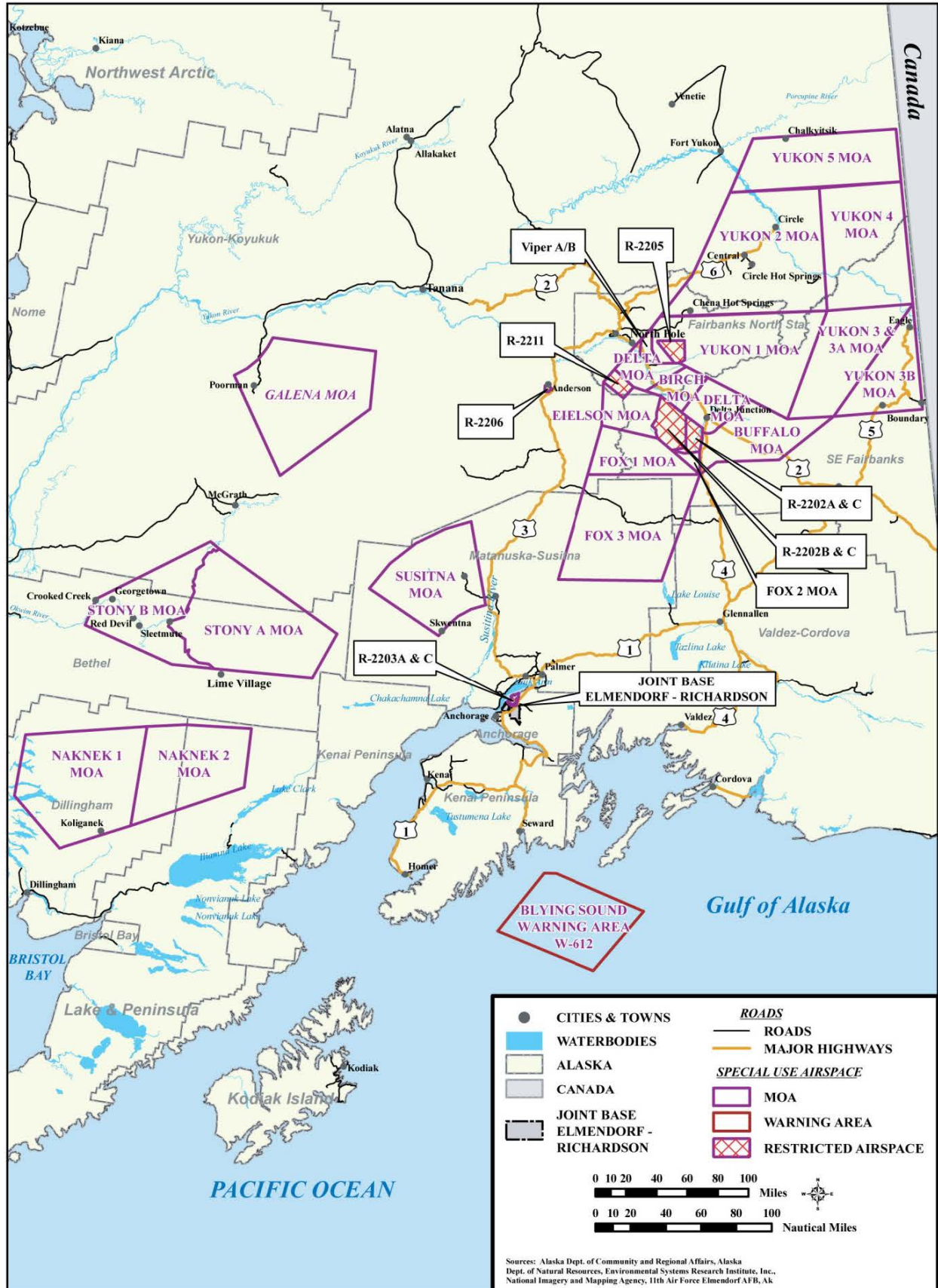


Figure 2.2-2. Alaska Training Special Use Airspace

2.0 Description of the Proposed Action and Alternatives

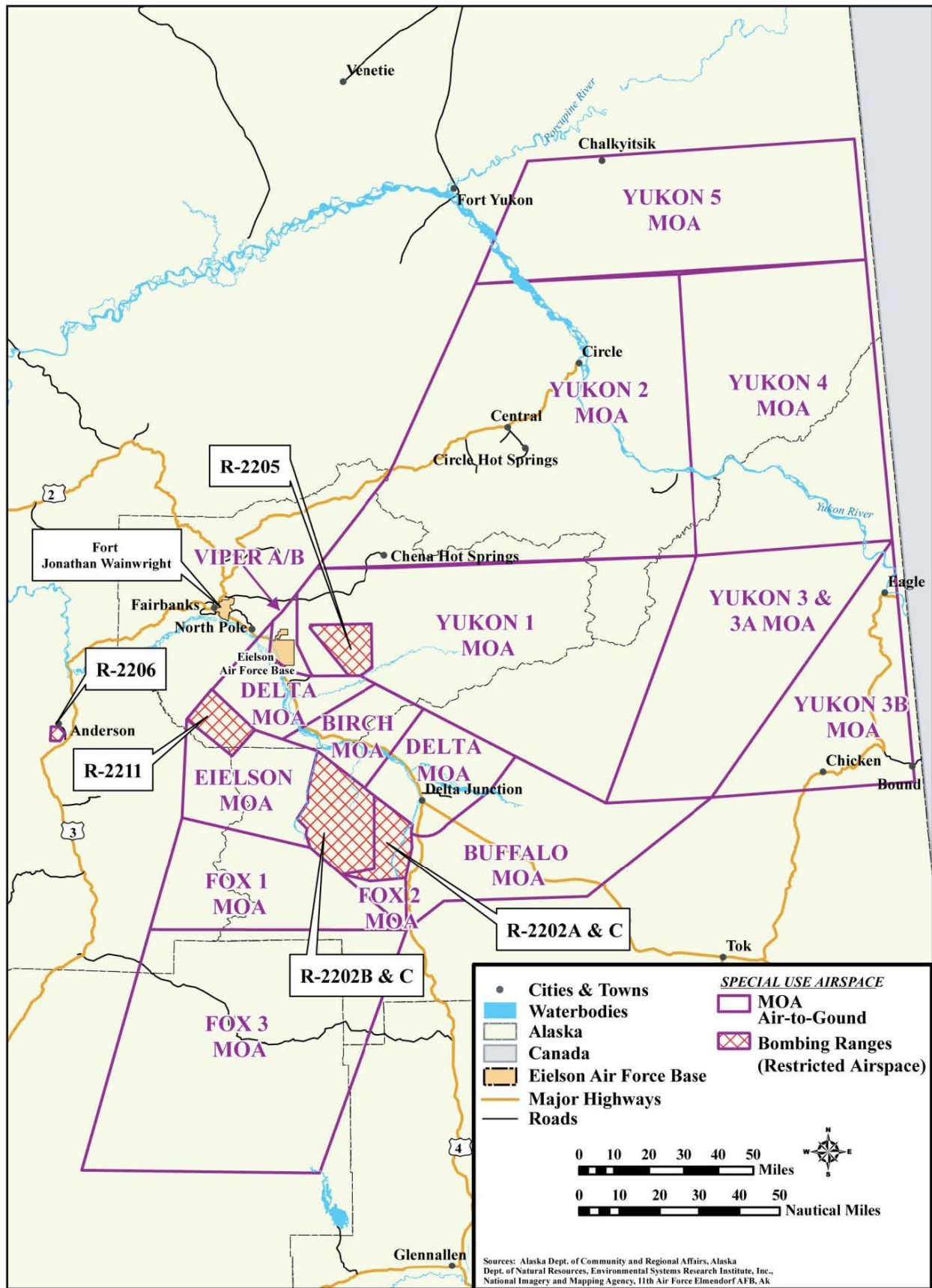


Figure 2.2-3. MOAs, Restricted Areas, and Air-to-Ground Ranges

2.0 Description of the Proposed Action and Alternatives

An ATCAA is airspace, often overlying a MOA, extending from 18,000 feet MSL to the altitude assigned by the FAA. Assigned on an as-needed basis and established by a letter of agreement between a military unit and the local FAA Air Route Traffic Control Center (ARTCC), each ATCAA provides additional airspace for training. ATCAAs are released to military users by the FAA only for the time they are to be used, allowing maximum access to the airspace by civilian aviation.

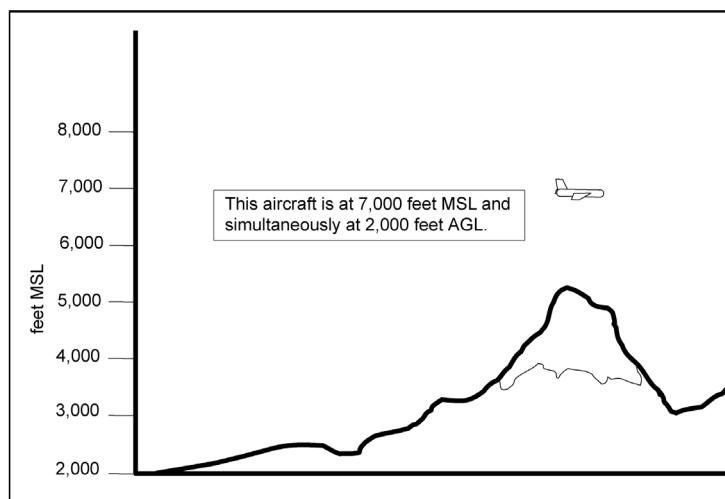
Currently, military training routes (MTR) are not utilized by the F-22s at JBER-Elmendorf and are not expected to be used under the proposed plus-up. MTRs are flight corridors used to practice high-speed, low-altitude training, generally below 10,000 feet MSL. They are described by a centerline, with defined horizontal limits on either side of the centerline and vertical limits expressed as minimum and maximum altitudes along the flight track.

Table 2.2-1 describes the current and projected F-22 air superiority missions and training. The F-22s typically fly one and one-half to two hour long missions, including takeoff, transit to and from the training airspace, training activities, and landing. Depending upon the distance and type of training activity, the F-22 spends between 20 to 60 minutes in a training airspace. On occasion during an exercise, the F-22 spends up to 90 minutes in one or a set of airspace units. The additional F-22s would train just as the existing F-22s currently train. On average, the additional F-22s would fly the same percentage of time after dark (30 percent) as do the F-22s currently using the airspaces. Barring a national emergency or a large scale exercise, after-dark sorties are not expected to occur during environmental night (10:00 p.m. to 7:00 a.m.).



The F-22 spends 70 percent of training time above 30,000 feet MSL.

The F-22 could use the full, authorized capabilities of the airspace units from 500 feet above ground level (AGL) to above 60,000 feet MSL. The F-22 would rarely (5 percent or less) fly below 10,000 feet MSL and consistently operates from 10,000 feet MSL to well above 30,000 feet MSL (see Table 2.2-2.) Actual flight altitudes in a specific airspace would depend upon the lower and upper limits of specific airspace units.



Notes:

AGL = above ground level; MSL = mean sea level;

More than 99 percent of supersonic flight would be conducted above 10,000 feet MSL, with approximately 75 percent occurring above 30,000 feet MSL. In authorized airspace, less than one percent of supersonic flight would occur below 10,000 feet MSL.

2.0 Description of the Proposed Action and Alternatives

Table 2.2-1. Current and Projected F-22 Training Activities (Page 1 of 2)

<i>Activity</i>	<i>Description</i>	<i>Airspace Type</i>	<i>Altitude (feet)</i>	<i>Time in Airspace</i>
Aircraft Handling Characteristics	Training for proficiency in use and exploitation of the aircraft's flight capabilities (consistent with operational and safety constraints), including, but not limited to, high/maximum angle of attack maneuvering, energy management, minimum time turns, maximum/optimum acceleration and deceleration techniques, and confidence maneuvers.	MOA and ATCAA	5,000 AGL to 60,000 MSL	0.5 to 1.0 hour
Basic Fighter Maneuvers	Training designed to apply aircraft (1 versus 1) handling skills to gain proficiency in recognizing and solving range, closure, aspect, angle, and turning room problems in relation to another aircraft, to either attain a position from which weapons may be launched, or defeat weapons employed by an adversary.	MOA and ATCAA	5,000 AGL to 30,000 MSL	0.5 to 1.0 hour
Air Combat Maneuvers	Training designed to achieve proficiency in formation (2 versus 1 or 2 versus 1+1) maneuvering, and the coordinated application of Basic Fighter Maneuvers to achieve a simulated kill or effectively defend against one or more aircraft from a pre-planned starting position, including the use of defensive countermeasures (chaff, flares). Air Combat Maneuvers may be accomplished from a visual formation, or short-range to beyond visual range.	MOA and ATCAA	5,000 AGL to 60,000 MSL	0.5 to 1.0 hour
Low-Altitude Training	Aircraft offensive and defensive operations at low altitude, G-force awareness at low altitude, aircraft handling, turns, tactical formations, navigation, threat awareness, defensive response, defensive countermeasures (chaff/flares), low-to-high and high-to-low altitude intercepts, missile defense, and combat air patrol against low/medium altitude adversaries.	MOA	500 AGL to 5,000 AGL	0.5 to 1.0 hour
Tactical Intercepts	Training (1 versus 1 up to 4 versus multiple adversaries) designed to achieve proficiency in formation tactics, radar employment, identification, weapons employment, defensive response, electronic countermeasures, and electronic counter countermeasures.	MOA and ATCAA	500 AGL to 60,000 MSL	0.5 to 1.0 hour
Night Operations	Aircraft intercepts (1 versus 1 up to 4 versus multiple adversaries) flown between the hours of sunset and sunrise, including tactical intercepts, weapons employment, offensive and defensive maneuvering, chaff/flare, and electronic countermeasures.	Warning Area, MOA, and ATCAA	2,000 AGL to 60,000 MSL	0.75 to 1.5 hour

2.0 Description of the Proposed Action and Alternatives
Table 2.2-1. Current and Projected F-22 Training Activities (Page 2 of 2)

<i>Activity</i>	<i>Description</i>	<i>Airspace Type</i>	<i>Altitude (feet)</i>	<i>Time in Airspace</i>
(Dissimilar) Air Combat Tactics	Multi-aircraft and multi-adversary (2 versus multiple to larger force exercises) conducting offensive and defensive operations, combat air patrol, defense of airspace sector from composite force attack, intercept and simulate and destroy bomber aircraft, destroy/avoid adversary ground and air threats with simulated munitions and defensive countermeasures, strike-force rendezvous and protection.	MOA and ATCAA	500 AGL to 60,000 MSL	0.5 to 1.0 hour
Basic Surface Attack	Air-to-ground simulated delivery of ordnance on a range.	MOA, R-	Surface to 60,000 MSL	0.5 to 1.0 hour
Tactical Weapons Delivery	More challenging multiple attack headings and profiles; pilot is exposed to varying visual cues, shadow patterns, and the overall configuration and appearance of the target. Supersonic speeds that can include target acquisition are added to the challenge.	ATCAA, MOA, R-	Surface to 60,000 MSL	0.5 to 1.0 hour
Surface Attack Tactics	Practiced in a block of airspace such as a MOA or Restricted Area that provides room to maneuver up to supersonic speeds. Defensive countermeasures may be deployed. Precise timing during the ingress to the target is practiced, as is target acquisition. Training includes egress from the target area and reforming into a tactical formation.	ATCAA, MOA, R-	Surface to 60,000 MSL	0.5 to 1.0 hour
LRSOW Delivery	Practiced in a MOA or ATCAA that provides for maneuvering room and supersonic speeds. Precise timing for speed, altitude, and launch parameters is practiced at high altitudes without release. Use of inert munitions in low altitude drops to evaluate timing and aircraft performance. Remote training using LRSOW at authorized ranges outside Alaska.	ATCAA, MOA, R-	Surface to 60,000 MSL	0.5 to 1.0 hour
Suppression of Enemy Air Defenses	Highly specialized mission requiring specific ordnance and avionics and can include supersonic speeds and defensive countermeasures. The objective of this mission is to simulate neutralizing or destroying ground-based anti-aircraft systems.	ATCAA, MOA, R-	Surface to 60,000 MSL	0.5 to 1.0 hour
Major Flying Exercises / Mission Employment (60 days per year)	Multi-aircraft and multi-adversary composite strike force exercise (day or night), air refueling, strike-force rendezvous, conducting air-to-ground strikes, strike force defense and escort, air intercepts, electronic countermeasures, electronic counter-counter measures, combat air patrol, defense against composite force, bomber intercepts, destroy/disrupt/avoid adversary fighters, defensive countermeasure (chaff/flare) use.	ATCAA, MOA, and R-	Surface to 60,000 MSL	0.5 to 1.0 hour

Notes:

MOA = Military Operations Area; ATCAA = Air Traffic Control Assigned Airspace; R- = Restricted Area; AGL = above ground level; MSL = mean sea level; LRSOW = Long-Range Standoff Weapon

Table 2.2-2. Current and Projected F-22 Altitude Use

<i>Altitude (feet)</i>	<i>Percent of Flight Hours: F-22</i>
>30,000 MSL	70%
10,000-30,000 MSL	25%
5,000-10,000 MSL	3%
2,000-5,000 AGL	1.5%
1,000-2,000 AGL	.25%
500-1000 AGL	0.25%

Additional F-22 operational aircraft would fly training flights in one or more of the Alaskan training airspaces, as do the existing F-22s. Activities in the training airspace are termed *sortie-operations*. A sortie-operation is defined as the use of one airspace unit by one aircraft. Each time a single aircraft flies in a different airspace unit, one sortie-operation is counted for that unit. Thus, a single aircraft can generate several sortie-operations in the course of a mission.

The JBER affected airspace units consist of MOAs and ATCAAs currently used by the F-22s for routine training. Figure 2.2-2 presents these airspaces. ATCAAs overlie nearly all of the MOAs. Figure 2.2-3 presents a closer view of Restricted Areas with the air-to-ground ranges currently used for F-22 air-to-ground missions.

The additional F-22s would employ supersonic flight to train with the full capabilities of the aircraft as do the existing F-22s. All supersonic flight would occur at altitudes and within airspace already authorized for such activities. The augmented F-22 squadrons would continue to fly approximately 25 percent of the time spent in MOAs and ATCAAs at supersonic speed. The F-22 has greater performance capabilities than either the F-15C or F-15E, and pilots must train to use those capabilities.

2.2.1 F-22 Training Flights Within Alaskan Airspace

The F-22 has the potential to use missiles or a gun in air-to-air engagements. Training for the use of these weapons is predominantly simulated. Simulating air-to-air attacks uses all the radar and targeting systems available on the F-22, but nothing is fired in Alaskan airspace. F-22 live-fire air-to-air training would continue to occur during specialized training or exercises at ranges authorized for these activities.

The current sortie-operations in JBER MOAs within Alaska are presented in Table 2.2-3. The existing 36 F-22s use the Fox, Stony, and Susitna MOAs and associated ATCAAs for 65 percent of their training sortie-operations. Table 2.2-4 compares existing MOA training of JBER-based F-22 aircraft with the proposed training activity of the augmented squadrons of F-22 aircraft.



Operational pilots must continually train to maintain skills essential for combat. Existing Alaskan airspace would meet the training needs of F-22 pilots based at JBER.

The F-22 aircraft do not train in MTRs, and they are not projected to do so with current missions. F-22 training does include incidental training in the Blying Sound Warning Area (W-612) (see Figure 2.2-2). A Warning Area is an over-water airspace similar to range airspace over land.

Table 2.2-3. Baseline and Projected Annual Sortie-Operations in Regional MOAs

Airspace Unit	Floor (feet AGL)	Ceiling ¹ (feet MSL)	FY 2009 Use				Current Year Use - BASELINE ²				Proposed Use ²		
			F-22 ³	F-15C	Other	Total	F-22 ³	F-15C	Other	Total	F-22 ⁴	Other ⁵	Total
Birch	500	5,000	0	0	2,149	2,149	0	0	2,149	2,149	0	2,149	2,149
Buffalo	300	7,000	0	0	2,150	2,150	0	0	2,150	2,150	0	2,150	2,150
Delta ⁶	3,000	18,000	378	360	2,377	3,115	378	171	2,377	2,926	456	2,548	3,004
Eielson	100	18,000	1,284	1,145	4,613	7,042	1,284	503	4,613	6,400	1,550	5,116	6,666
Fox 1	5,000	18,000	1,284	1,145	4,613	7,042	1,284	503	4,613	6,400	1,550	5,116	6,666
Fox 2	5,000	18,000	1,284	1,145	4,613	7,042	1,284	503	4,613	6,400	1,550	5,116	6,666
Fox 3	5,000	18,000	1,307	1,204	3,854	6,365	1,307	551	3,854	5,712	1,577	4,405	5,982
Galena	1,000	18,000	16	200	40	256	16	192	40	248	19	232	251
Naknek 1/2	3,000	18,000	95	205	10	310	95	158	10	263	115	168	282
Stony A/B	100	18,000	1,565	1,321	8	2,894	1,565	539	8	2,112	1,889	547	2,435
Susitna	5,000 AGL or 10,000 MSL, whichever is higher	18,000	1,202	901	15	2,118	1,202	300	15	1,517	1,451	315	1,766
Viper	500	18,000	392	384	3,999	4,775	392	188	3,999	4,579	473	4,187	4,660
Yukon 1	100	18,000	392	384	3,999	4,775	392	188	3,999	4,579	473	4,187	4,660
Yukon 2	100	18,000	392	382	3,026	3,800	392	186	3,026	3,604	473	3,212	3,685
Yukon 3 A/B ⁷	100	18,000	392	382	2,636	3,410	392	186	2,636	3,214	473	2,822	3,295
Yukon 4	100	18,000	392	382	2,582	3,356	392	186	2,582	3,160	473	2,768	3,241
Yukon 5 ⁸	5,000	18,000	386	372	2,447	3,205	386	179	2,447	3,012	466	2,626	3,092

Notes:

1. ATCAAs overlie all MOAs in the table.
2. Current and future year use expected to be same as FY 2009 use except for reduction in F-15C operations resulting from 19th Fighter Squadron (19 FS) relocation from JBER-Elmendorf completed in FY10. The number of sortie operations conducted by 19 FS is assumed to be approximately equal to the sorties conducted by a single F-22 squadron. Each of the two F-22 squadrons at JBER-Elmendorf was assumed to fly 1/2 of the FY09 F-22 sortie-operations. Therefore, current year F-15C sortie operations by transient aircraft were estimated to be the number of F-15C operations in FY09 minus half the FY09 number of F-22 operations.
3. Numbers in this column are for 2 F-22 squadrons (36 primary aircraft).
4. Numbers in this column are for 2 plus-up F-22 squadrons (42 primary aircraft).
5. 'Other' aircraft include F-15C aircraft as well as other transient aircraft types
6. Delta MOA sortie-operations are derived from historic use of the Delta T-MOA.
7. Consists of Yukon 3A (100 AGL-10,000 MSL); Yukon 3B (2,000 AGL-18,000 MSL).
8. Used for MFE only.

AGL = above ground level; MSL = mean sea level; ATCAA = Air Traffic Control Assigned Airspace; MOA = Military Operations Area.

2.0 Description of the Proposed Action and Alternatives

Table 2.2-4. Current and Projected Annual Training Munitions

<i>Training Munition Class</i>	<i>Current F-22</i>	<i>Projected F-22</i>
Ammunition		
20 mm	26,659	31,102
Air to Ground		
250 pound	200	200
1,000 pound	50-60	60-70

2.2.2 Air-to-Ground Training

The F-22 has an air-to-ground mission. F-22 pilots spend approximately 80 percent of their training in air-to-air missions and 20 percent of their training in air-to-ground missions.

Most air-to-ground training would be simulated, where no munitions would be released from the aircraft. The F-22s use avionics to simulate ordnance delivery on a target. This type of training could be conducted in any of the airspace units and would not require an air-to-ground range.

Air-to-ground training also includes ordnance delivery training. All ordnance delivery training would continue to adhere to the requirements and restrictions of the ranges. Table 2.2-4 presents the current and projected F-22 air-to-ground munitions used in training. The primary air-to-ground ordnance carried by the F-22 is the Guided Bomb Unit (GBU)-32, and will also include the Small Diameter Bomb (SDB) (GBU-39/B). The GBU-32 is a 1,000 pound equivalent variant of the Joint Direct Attack Munition (JDAM). JDAMs are guided to the target by an attached Global Positioning System receiver. SDBs are guided 250 pound equivalent munitions. Training with these weapons in Alaskan airspace could include accelerating to launch speed, altitude, and delivery profile prior to opening the weapons bay. JDAMs or SDBs can only be deployed at approved air-to-ground ranges.

Actual live ordnance delivery training at approved delivery profiles occurs during the times when F-22 squadrons are deployed to locations where levels of munitions training are authorized. Such locations include the Nellis Range Complex in Nevada, the Utah Test and Training Range, and the approved ranges associated with Eglin AFB. The negligible level of use of these remote ranges and the current level of use by others suggest that projected F-22 use does not warrant additional detailed environmental analysis for these ranges.

F-22 training with inert munitions comparable in size to a JDAM or an SDB could occur on approved Alaskan Ranges. F-22 flight profiles, altitudes, and speed would be restricted to ensure that such munitions meet approved range weapon safety footprints.

2.2.3 Defensive Countermeasures

Chaff and flares are the principal defensive countermeasures dispensed by military aircraft to avoid detection or attack by enemy air defense systems.



Ground personnel are trained in handling munitions and chaff and flares to ensure the F-22 operational wing is combat ready.

2.0 Description of the Proposed Action and Alternatives

Although the F-22's low visibility features reduce its detectability, pilots must still train to employ defensive countermeasures. The additional F-22s would use RR-180/AL chaff and MJU-10/B flares in approved Alaskan airspace as the existing F-22s do. Defensive chaff and flares are used to keep aircraft from being successfully targeted by weapons such as surface-to-air missiles, anti-aircraft artillery, or other aircraft. Appendix A describes the characteristics of chaff, and Appendix B describes the characteristics of flares used in defensive training.

Effective use of chaff and flares in combat requires frequent training by aircrews to master the timing of deployment and the capabilities of the defensive countermeasure, and by ground crews to ensure safe and efficient handling of chaff and flares. Defensive countermeasures deployment in JBER-authorized airspace is governed by a series of regulations based on safety, environmental considerations, and defensive countermeasures limitations. These regulations establish procedures governing the use of chaff and flares over ranges, other government-owned and controlled lands, and nongovernment-owned or controlled areas. Chaff and flares would continue to be used in approved training airspace. Table 2.2-5 presents the existing and proposed F-22 chaff and flare use.

A bundle of chaff consists of approximately 0.5 to 5.6 million fibers, each thinner than a human hair, that are cut to reflect radar signals and, when dispensed from aircraft, form a brief electronic "cloud" that breaks the radar signal and temporarily hides the maneuvering aircraft from radar detection. With each F-22 chaff bundle, approximately 3.5 ounces of chaff fibers are widely dispersed along with four 1-inch by ½-inch by 1/8-inch pieces of plastic or nylon and six approximately 2-inch by 3-inch pieces of parchment paper which fall to the ground.

Table 2.2-5. Existing and Proposed F-22 Annual Chaff and Flare Use

<i>Aircraft</i>	<i>Existing</i>	<i>Proposed</i>	<i>Change</i>
Chaff Bundles	17,132	19,987	+2,855
Flares	22,747	26,538	+3,791

Source:

1. FY 2009 Usage

Flares ejected from aircraft provide high-temperature heat sources that mislead heat-sensitive or heat-seeking targeting systems. Flares burn for less than five seconds at a temperature of approximately 2,000 degrees Fahrenheit to simulate jet exhaust. During the burn, a flare descends approximately 400 feet. The burning magnesium flare pellet is completely consumed and two ¼ inch by 2-inch by 2-inch pieces of plastic or nylon, one 2-inch by 1-inch by ½-inch plastic Safety and Initiation (S & I) device, and an up to 4-inch by 15-inch piece of aluminum-coated duct tape-type mylar wrapping material fall to the ground. Restrictions for flare use in Alaskan MOAs are described below.

- Flares may only be deployed above 5,000 feet AGL from June 1 through September 30 to reduce the potential for fires.
- For the remainder of the year, the minimum altitude for flare use is 2,000 feet AGL, well above the safety standards set by the Department of Defense (DoD).

2.3 Alternatives Considered But Not Carried Forward

On July 31, 2010, the Air Force Secretariat, after review of the basing of the Air Force's F-22 aircraft, determined the most effective basing for the F-22. This requires relocating one Holloman F-22 Squadron to an existing F-22 base, Tyndall AFB, Florida, and redistributing the second Holloman AFB F-22 squadron aircraft to units at three existing F-22 bases. The F-22s would be redistributed as follows: JBER-Elmendorf, Alaska, would receive six additional primary aircraft; Langley AFB, Virginia, would receive six additional primary aircraft; and Nellis AFB, Nevada, would receive two additional primary aircraft.

2.3.1 *Alternative Locations*

The Air Force Secretariat reviewed F-22 aircraft bases and operational requirements and determined that the proposed redistribution of existing squadrons and aircraft would maximize combat aircraft and squadrons available for operational contingencies. Consolidating aircraft at existing F-22 bases, including JBER, enhances F-22 operational flexibility.

Redistributing the six primary and one back-up F-22 aircraft designated for JBER to other locations would not be consistent with achieving combat readiness. Different distributions or locations of aircraft represent alternatives considered but not carried forward for analysis in this EA.

2.3.2 *Alternative Flight Operations at JBER*

Alternative percentage distributions of flight operations for the JBER-Elmendorf main runway (06/24) and the cross-wind runway (16/34) were evaluated for F-22 and C-17 aircraft operations. A range of F-22 flight operations from 45 percent to 100 percent on the main runway were evaluated to determine operational and noise effects. C-17 flight operations were also evaluated for short-field cross-wind runway operations during the day and night. Potential alternatives which exceeded approximately 25 percent of F-22 launches or some C-17 closed pattern operations on the cross-wind runway were estimated to produce off-base noise impacts south of the base. Operations on the cross-wind runway above the approximate 25 percent use described in the proposed action were determined to be alternatives considered but not carried forward.

2.4 No Action Alternative

No Action for this EA means no beddown of an additional six F-22 primary aircraft would occur at JBER at this time. Analysis of the No Action Alternative provides a benchmark for environmental analysis. Section 1502.14(d) of NEPA requires an EA to analyze the No Action Alternative. The No Action Alternative would result in no additional F-22 aircraft being assigned to JBER, no F-22 related personnel changes, and no additional F-22 flight activities near the base or in training airspace.

For this EA, No Action is the baseline condition, with two squadrons of F-22 aircraft based at JBER. Table 2.2-3 presents the airspace training associated with existing F-22 squadrons. This airspace training would be expected to continue under No Action. Taking no action would

2.0 Description of the Proposed Action and Alternatives

negatively affect the overall consolidation of F-22 combat aircraft and Air Force operational flexibility (see Section 1.0).

2.5 Environmental Impact Analysis Process

The Environmental Impact Analysis Process, in compliance with NEPA guidance, includes public and agency review of information pertinent to the Proposed Action, and provides a full and fair discussion of potential consequences to the natural and human environment. A Notice of Intent (NOI) to prepare an EA was published in the Anchorage Daily News, the Mat-Su Valley Frontiersman, and the Eagle River Star December 19 to 27, 2010. Public and agency inputs to the environmental analysis of the proposed F-22 plus-up were requested. Interagency and Intergovernmental Coordination for Environmental Planning (IICEP) letters were sent and responses received through January 2011. Government-to-government communication with potentially affected Alaska Native groups were conducted between December 2010 and February 2011.

2.5.1 EA Organization

This EA is organized into the following chapters and appendices. Chapter 1.0 describes the purpose and need of the proposal to beddown the additional six primary and one backup F-22 aircraft at JBER. A description of the Proposed Action and the No Action Alternative is provided in Chapter 2.0. Finally, Chapter 2.0 provides a comparative summary of the effects of the Proposed Action and No Action Alternative with respect to the various environmental resources.

Chapter 3.0 describes the existing conditions both at JBER-Elmendorf and within the Alaskan training airspace. Chapter 4.0 overlays the Chapter 2 Proposed Action on the Chapter 3 baseline conditions to produce the environmental consequences at JBER-Elmendorf and within the Alaskan training airspace. Chapter 5.0 presents a cumulative analysis, considers the relationship between short-term uses and long-term productivity identified for the resources affected, and summarizes the irreversible and irretrievable commitment of resources if the Proposed Action were implemented. References cited in the EA, lists of individuals and organizations contacted during the preparation of the EA, and a list of the document preparers is included after Chapter 5.0.

F-22 Plus-Up EA

Executive Summary

Chapter 1.0 Purpose and Need for F-22 Plus-Up at JBER

- 1.1 Background
- 1.2 Purpose of F-22 Plus-Up at JBER
- 1.3 Need for F-22 Plus-Up at JBER

Chapter 2.0 Description of Proposed Action and Alternatives

- 2.1 Proposed Action Elements Affecting JBER-Elmendorf
- 2.2 Proposed Action Elements Affecting Alaskan Airspace
- 2.3 Alternatives Considered But Not Carried Forward
- 2.4 No Action Alternative
- 2.5 Environmental Impact Analysis Process
- 2.6 Regulatory Compliance
- 2.7 Environmental Comparison of the Proposed Action No Action Alternative

Chapter 3.0 Affected Environment

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- 4.10 Environmental Justice

Chapter 5.0 Cumulative Impacts

- 5.1 Cumulative Effects Analysis
- 5.2 Other Environmental Considerations

References

List of Preparers

Appendices

2.0 Description of the Proposed Action and Alternatives

In addition to the main text, the following appendices are included in this document: Appendix A, Characteristics of Chaff; Appendix B, Characteristics and Analysis of Flares; Appendix C, Agency Coordination; Appendix D, Aircraft Noise Analysis and Airspace Operations; Appendix E, Section 7 (Endangered Species Act) Compliance Wildlife Analysis for F-22 Plus Up Environmental Assessment; Appendix F, Review of Effects of Aircraft Noise, Chaff, and Flares on Biological Resources.

2.5.2 Scope of Resource Analysis

The Proposed Action has the potential to affect certain environmental resources. These potentially affected resources have been identified through communications with state and federal agencies and Alaska Natives, review of past environmental documentation, and public input. Specific environmental resources with the potential for environmental consequences include airspace management and air traffic control (including airport traffic), noise, safety, air quality, biological resources, cultural resources, land use (including recreation and transportation), socioeconomics, and environmental justice. Since there would be no construction associated with the Proposed Action, there would be no expected environmental consequences to certain resources, such as water and earth resources. Therefore, these resources are not included in this EA.

2.5.3 Public and Agency Input

The Air Force initiated early public and agency involvement in the environmental analysis of the proposed plus-up of the additional six primary and one backup F-22 aircraft. The Air Force distributed IICEP letters and published notices of the intent to prepare this EA in the *Anchorage Daily News*, the *Mat Su Valley Frontiersman*, and the *Eagle River Alaska Star*. These announcements solicited public and agency input on the proposal. The IICEP Distribution List and Agency Coordination are presented in Appendix C.



JBER F-22 pilots are residents of Alaska and listen to the concerns of agencies and the public to be good neighbors during operational training.

The U.S. Fish and Wildlife Service (USFWS) response to the IICEP letter included their statement that there are no federally listed or proposed species and/or designated or proposed critical habitat for which they are responsible within the action area of the project (USFWS 2011). The National Marine Fisheries Service determined that the F-22 plus-up may affect but is unlikely to adversely affect the Cook Inlet beluga whale (CIBW) (Appendix C).

Notices of the intent to prepare this EA with enclosed stamped return postcards were sent to 35 Alaska Native villages and Tribal government entities. Nine Alaska Native villages returned the response postcards. No specific comments on the proposed action from any Alaska Native village or Tribal government entity were received during or after the scoping period (Appendix C). Information from previous consultation with Alaska Natives has been included in this EA.

No written comments were received from the public in response to the notices of the intent to prepare this EA published in the local newspapers.

2.0 Description of the Proposed Action and Alternatives

This EA and draft FONSI were issued for a 30-day public and agency review and comment period. Public and Agency comments received during the entire environmental impact analysis process have been incorporated into this EA.

2.6 Regulatory Compliance

This EA analyzes the potential environmental consequences associated with the F-22 plus-up according to the requirements of NEPA (42 U.S.C. 4321 et seq.), CEQ regulations (40 CFR 1500–1508), and *The Environmental Impact Analysis Process* (32 CFR 989 et seq.). NEPA is the basic national charter for identifying environmental consequences of major federal actions. NEPA ensures that environmental information is available to the public, agencies, and the decision makers before decisions are made and before actions are taken.

2.6.1 National Environmental Policy Act

In accordance with NEPA of 1969 (42 U.S.C. 4321-4347), *CEQ Regulations for Implementing the Procedural Provisions of NEPA* (40 CFR §§ 1500-1508), and 32 CFR 989, *et seq.*, *Environmental Impact Analysis Process (EIAP)* (formerly promulgated as AFI 32-7061), the Air Force is preparing this EA to consider the potential consequences to the human and natural environment that may result from implementation of this proposal.

NEPA requires federal agencies to take into consideration the potential environmental consequences of proposed actions in their decision-making process. The intent of NEPA is to protect, restore, and enhance the environment through well-informed federal decisions. The CEQ was established under NEPA to implement and oversee federal policy in this process. The CEQ subsequently issued the *Regulations for Implementing the Procedural Provisions of the NEPA* (40 CFR Sections 1500–1508) (CEQ 1978).

The activities addressed within this document constitute a federal action and therefore must be assessed in accordance with NEPA. To comply with NEPA, as well as other pertinent environmental requirements, the decision-making process for the Proposed Action includes the development of the EA to address the environmental issues related to the proposed activities. The Air Force implementing procedures for NEPA are contained in 32 CFR 989 *et seq.*, *EIAP*.

2.6.2 Endangered Species Act

The ESA of 1973 (16 USC §§ 1531–1544, as amended) established measures for the protection of plant and animal species that are federally listed as threatened and endangered, and for the conservation of habitats that are critical to the continued existence of those species. Compliance with the ESA requires communication with the National Marine Fisheries Service (NMFS) and the USFWS in cases where a federal action could affect listed threatened or endangered species, species proposed for listing, or candidates for listing. Federal agencies must evaluate the effects of their proposed actions through a set of defined procedures, which can include the preparation of a Biological Assessment and can require formal consultation with USFWS under Section 7 of the Act. The primary focus of this consultation is to request a determination of whether any of these species occur in the proposal area. If any of these species is present, a determination is made of any potential adverse effects on the species. The appropriate USFWS

2.0 Description of the Proposed Action and Alternatives

and NMFS offices as well as state agencies were contacted to inform them of the proposal and to request data regarding applicable protected species. The USFWS replied on February 8, 2011 that there are no federally listed or proposed species and/or designated or proposed critical habitat for which they are responsible within the action area of the project. The NMFS replied on February 22, 2011 with their determination that the F-22 plus-up may affect but is unlikely to adversely affect the CIBW. Appendix C includes copies of relevant coordination letters, and Appendix E is the wildlife study used in informal consultation with the NMFS under Section 7 of the ESA.

2.6.3 Cultural Resources Regulatory Requirements

The NHPA of 1966 (16 USC § 470) established the National Register of Historic Places (NRHP) and the Advisory Council on Historic Preservation (ACHP) outlining procedures for the management of cultural resources on federal property.

Cultural resources can include archaeological remains, architectural structures, and traditional cultural properties such as ancestral settlements, historic trails, and places where significant historic events occurred. NHPA requires federal agencies to consider potential impacts to cultural resources that are listed, nominated to, or eligible for listing on the NRHP; designated a National Historic Landmark; or valued by modern Alaska Natives for maintaining their traditional culture. Section 106 of NHPA (as amended) requires federal agencies to take into account the effects of their undertakings on historic properties. *Protection of Historic and Cultural Properties* (36 CFR 800 [1986]) provides an explicit set of procedures for federal agencies to meet their obligations under Section 106 of the NHPA, which includes inventorying of resources and consultation with State Historic Preservation Officers (SHPOs).

The American Indian Religious Freedom Act (AIRFA) (42 USC § 1996) established federal policy to protect and preserve the rights of Native Americans to believe, express, and exercise their traditional religions, including providing access to sacred sites.

AFI 32-7065, *Cultural Resources Management* (2004) establishes guidelines for managing and protecting cultural resources on property affected by Air Force operations in the U.S. and U.S. territories and possessions.

The preservation of Alaska Native cultural resources is coordinated by the SHPO, as mandated by the NHPA and its implementing regulations. Letters were sent to potentially affected Alaska Native communities informing them of the proposal (Appendix C). Further communication is included as part of this EA review process.

2.6.4 Clean Air Act

The Clean Air Act (CAA) (42 USC §§ 7401-7671q, as amended) provided the authority for the United States Environmental Protection Agency (USEPA) to establish nationwide air quality standards to protect public health and welfare. Federal standards, known as the National Ambient Air Quality Standards (NAAQS), were developed for six criteria pollutants: ozone (O₃), nitrogen dioxide (NO₂), carbon monoxide (CO), sulfur dioxide (SO₂), both coarse and fine inhalable particulate matter (less than or equal to 10 micrometers in diameter [PM₁₀], and particulate matter less than or equal to 2.5 micrometers in diameter [PM_{2.5}]), and lead (Pb). The

2.0 Description of the Proposed Action and Alternatives

Act also requires that each state prepare a State Implementation Plan (SIP) for maintaining and improving air quality and eliminating violations of the NAAQS. In nonattainment and maintenance areas, the CAA requires federal agencies to determine whether their proposed actions conform with the applicable SIP and demonstrate that their actions will not (1) cause or contribute to a new violation of the NAAQS, (2) increase the frequency or severity of any existing violation, or (3) delay timely attainment of any standard, emission reduction, or milestone contained in the SIP. JBER is in attainment for all criteria pollutants and therefore an Air Conformity Review under the CAA Amendments is not required as emissions for air pollutants are below the *de minimis* threshold.

2.6.5 Other Regulatory Requirements

Additional regulatory legislation that potentially applies to the implementation of this proposal includes guidelines promulgated by Executive Order (EO) 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, to ensure that disproportionately high and adverse human health or environmental effects on citizens in either of these categories are identified and addressed, as appropriate. Additionally, potential health and safety impacts that could disproportionately affect children are considered under the guidelines established by EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*.

2.7 Environmental Comparison of the Proposed Action and No Action Alternative

Table 2.7-1 summarizes the consequences at JBER-Elmendorf and the training airspace of implementing the Proposed Action, and includes the No Action Alternative. This summary is derived from the detailed analyses presented in Chapter 4.0. Chapter 5.0 addresses cumulative consequences and finds that there are no significant cumulative environmental consequences resulting from an F-22 Plus-up decision when added to other past, present, or reasonably foreseeable future federal and non-federal actions.



The Proposed Action is to beddown six additional primary and one backup F-22 aircraft.

2.0 Description of the Proposed Action and Alternatives

Table 2.7-1. Summary of Impacts by Resource (Page 1 of 3)

<i>Resource</i>	<i>Proposed Action Options</i>	<i>No Action</i>
Airspace Management and Air Traffic Control	<p>Base. AATA management of airspace would not be impacted by additional F-22 sorties.</p> <p>Airspace. The additional aircraft would not affect regional airspace management, and usage of the airspace would not change to the extent that civil aviation could be affected.</p>	Existing terminal airspace, MOA, range, and other airspace usage would not change; F-22s would continue to train from JBER-Elmendorf and continue to train in the airspace as they do today.
Noise	<p>Base. Portions of JBER would experience increased noise levels. No JBER residences would be exposed to noise levels greater than 80 L_{dn}. Structures in the flightline would continue to be exposed to noise at greater than 80 dB L_{dn}. Workers on JBER are protected against possible noise impacts by adherence to DoD noise management guidelines.</p> <p>Off-base areas expected to be within the 65 dB L_{dn} noise contour are part of the Port of Anchorage, a portion of the Knik Arm, and a small area of land across the Knik Arm. The slightly increased area would not be expected to impact human or natural resources in off-base areas.</p> <p>Airspace. The change between baseline conditions and the Proposed Action would be 1 dB L_{dnmr} or less in all training airspaces. Sonic booms under training MOAs would increase by between 1 and 3 per month from the existing 10 to 26 per month. Sonic booms would not pose a health or other risk, but could increase annoyance.</p>	<p>Noise contours and conditions at JBER would remain the same as baseline conditions.</p> <p>Continuation of current noise levels from subsonic and supersonic flight in training airspace. No change in sonic booms in any MOAs.</p>
Safety	<p>Base. No change in off-base safety conditions or in Bird-Aircraft Strike Hazard (BASH), munitions, or personnel safety. F-22 Class A mishap rate expected to be comparable to F-15.</p> <p>Airspace. No substantive change in or impacts to flight, ground, or other safety aspects. F-22 flight altitudes and situational awareness is expected to result in no safety impacts within the airspace. No safety impacts from chaff and flare use. Flare use would continue to adhere to altitude and seasonal restrictions.</p>	<p>Continuation of current safety conditions at JBER-Elmendorf.</p> <p>No change from existing training by F-22s in airspace. Continued use of chaff and flares in training airspace.</p>

2.0 Description of the Proposed Action and Alternatives

Table 2.7-1. Summary of Impacts by Resource (Page 2 of 3)

<i>Resource</i>	<i>Proposed Action Options</i>	<i>No Action</i>
Air Quality	<p>Base. Plus-up of six primary F-22 aircraft would not affect air quality. JBER-Elmendorf is in attainment for all criteria pollutants. Anticipated emission resulting from the Proposed Action would not cause or contribute to a new NAAQS violation. Green House Gas emissions would not change globally by a transfer of aircraft from one base to another.</p> <p>Airspace. Because the F-22 flight altitude is above the mixing height, along with the large area of training airspace, the approximate 16.7 percent increase in training sorties would not affect air quality.</p>	Aircraft operations at the base or in the airspace would not change from current F-22 training activity. There would be no change to the current air quality.
Hazardous Materials and Waste Management	<p>Base. No significant effect on hazardous materials, hazardous wastes, or the Environmental Restoration Program (ERP).</p> <p>Existing hazardous waste accumulation sites and procedures are adequate to handle the changes anticipated with the expected six additional primary aircraft.</p> <p>Airspace. No significant effect on hazardous materials or hazardous wastes in training airspace.</p>	No change from existing use of hazardous materials and generation of hazardous waste.
Biological Resources	<p>Base. Potential effects to CIBW include slight potential for behavioral response to the overflight of F-22s over the Knik Arm. Approximately 0.04 CIBW individuals are projected to be behaviorally harassed annually resulting from the noise generated by the proposed additional F-22 flying operations (an estimated four whales in 100 years). NMFS determined that the plus-up may affect, but is unlikely to adversely affect, the CIBW. No sensitive species, including threatened or endangered species, are expected to be impacted by the additional F-22 aircraft.</p> <p>Airspace. Slight increase in subsonic noise from current conditions with no change in effects to wildlife. Increase in sonic booms may startle some individual animals. However, regional wildlife in the affected MOAs has previously experienced sonic booms and is likely habituated. Increase in paper, plastic, and other residual pieces from chaff and flare use would not be expected to affect biological resources.</p>	<p>Biological resources would not change from existing conditions.</p> <p>No change from existing conditions with military training overflights and sonic booms. Continued sonic booms with the potential to startle wildlife. Continued chaff and flare usage.</p>

2.0 Description of the Proposed Action and Alternatives

Table 2.7-1. Summary of Impacts by Resource (Page 3 of 3)

<i>Resource</i>	<i>Proposed Action Options</i>	<i>No Action</i>
Cultural Resources	<p>Base. No construction and no impacts to historic properties at JBER-Elmendorf.</p> <p>Airspace. No impacts to historic properties under the airspace.</p> <p>Increase in sonic booms, when discernible, may annoy users of land, but would not be expected to affect Alaska Native subsistence hunting.</p>	No change from existing conditions.
Land Use/ Transportation/ Recreation	<p>Base. No change in land use or transportation on base. Some extension of the 65 dB L_{dn} noise contour over 6.6 acres of compatible land uses in the Port of Anchorage, 410.7 acres over water of the Knik Arm, and over a 0.2 acre area across the Knik Arm. Industrial land uses would be compatible with existing and projected noise levels.</p> <p>Airspace. No affect to land use or land use patterns under the airspace. Recreationists, hunters, and fishermen may discern an increase in sonic booms.</p>	<p>No change to the noise environment on the base or off the base.</p> <p>No F-22 plus-up change in base personnel.</p> <p>No change from existing airspace use conditions. Continued presence of military aircraft and sonic booms under training airspace.</p>
Socioeconomics	<p>Base. No measurable effect upon the regional economy with an addition of less than one percent of the personnel and no new construction.</p> <p>Airspace. No discernible effects on social or economic conditions under the airspace. Increase in sonic booms, where discernible, may annoy some individuals participating in subsistence or recreational hunting and/or fishing. Any disturbance would not be expected to affect activities under the airspace or local economies that rely on subsistence resources.</p>	<p>No F-22 plus-up induced change in base personnel.</p> <p>No change from existing airspace use conditions.</p> <p>No increase in sonic booms.</p>
Environmental Justice	<p>Base. No disproportionate off-base impacts are anticipated on disadvantaged populations. There would be no health or safety risks to children. This includes no 65 dB L_{dn} noise contours off-base to the community of Mountain View.</p> <p>Airspace. Distributions of Alaska Natives under the airspace are representative of rural populations throughout the state. No disproportionate impact to minority and low-income populations anticipated. No health and safety effect to children under the airspace.</p>	No change to existing base or airspace conditions. Continued military training in airspace over rural populations.

3.0 BASE AND TRAINING AIRSPACE AFFECTED ENVIRONMENT

This chapter contains the environment potentially affected by the Proposed Action. The NEPA requires that the analysis address those areas and components of the environment with the potential to be affected; locations and resources with no potential to be affected need not be analyzed.

Each environmental resource discussion begins with an explanation of the potential geographic scope of any potential consequences, the Region of Influence (ROI). For most resources in this chapter, the ROI is defined as the vicinity of the airfield where F-22s are located or the existing military training airspace where F-22s train. In this EA, the airfield and its vicinity are termed JBER-Elmendorf. For some resources (such as Noise, Air Quality, and Socioeconomics), the ROI extends over a larger jurisdiction unique to the resource.

The *Existing Condition* of each relevant environmental resource is described to give the public and agency decision-makers a meaningful point from which they can compare potential future environmental, social, and economic effects. The baseline conditions described in this chapter constitute conditions under the No Action Alternative.

3.1 Airspace Management and Air Traffic Control

The affected environment or ROI for F-22 aircraft operations at JBER-Elmendorf includes the airfield, airspace surrounding the airfield, and airspace designated for military training in Alaska. Airspace management and Air Traffic Control (ATC) is defined as the direction, control, and handling of flight operations in the “navigable airspace” that overlies the geopolitical borders of the U.S. and its territories. “Navigable airspace” is airspace above the minimum altitudes of flight prescribed by regulations under USC Title 49, Subtitle VII, Part A, and includes airspace needed to ensure safety in the takeoff and landing of aircraft, as defined in FAA Order 7400.2E (49 USC). This navigable airspace is a limited natural resource that Congress has charged the FAA to administer in the public interest as necessary to ensure the safety of aircraft and its efficient use (FAA Order 7400.2E 2000).

3.1.1 Base Airfield and Vicinity Existing Conditions

JBER-Elmendorf manages airspace in accordance with processes and procedures detailed in AFI 13-201, *Air Force Airspace Management* (Air Force 2001b; 2009). AFI 13-201 implements Air Force Planning Document 13-2, *Air Traffic Control, Airspace, Airfield, and Range Management*, and DoD Directive 5030.19, *DoD Responsibilities on Federal Aviation and National Airspace System Matters*. This AFI addresses the aeronautical matters governing the efficient planning, acquisition, use, and management of airspace required to support Air Force flight operations (Air Force 2001b).

Airspace supporting operations at JBER-Elmendorf are within the Anchorage Alaska Terminal Area (AATA). The AATA is divided into six segments: the International Segment; the Seward Highway Segment; the Lake Hood Segment; the Merrill Segment; the Elmendorf Segment; and, the Bryant Segment (3 WG 2004).

Class D controlled airspace has been established around the JBER-Elmendorf airfield. This controlled airspace abuts the Class C controlled airspace around Anchorage International Airport to the southwest, and the Restricted Area R-2203 over JBER-Fort Richardson to the northeast. While the base control tower manages arrivals and departures at JBER-Elmendorf, Anchorage Approach Control has overall responsibility for traffic management within the AATA. Detailed processes, procedures, and altitude separation requirements that must be followed by military and civilian pilots operating within the AATA are published in aeronautical charts.

Aircraft at the base have flown in this airspace for more than 60 years without conflict with civil aviation. While the AATA is congested, continued coordination between base ATC and Anchorage Approach Control minimizes conflicts.

The existing conditions include approximately 40,000 to 60,000 operations per year at JBER-Elmendorf (see table 2.1-2). The base control tower coordinates closely with the AATA to support military and civil aviation in the region.



JBER-Elmendorf actively supports AATA management of the regional airspace. That support includes transient military aircraft such as this C-5.

3.1.2 Training Airspace Existing Conditions

Navigable airspace is a national resource administered by the FAA. FAA has charted and published SUA for military and other governmental activities. Management of SUA considers how airspace is designated, used, and administered to best accommodate the individual and common needs of civil and military aviation. The FAA considers multiple and sometimes competing demands for aviation airspace in relation to airport operations, Federal Airways, Jet Routes, military flight training activities, and other special needs to determine how the National Airspace System can best be structured to address all user requirements.

The FAA has designated four types of airspace within the U.S.: Controlled, Special Use, Other, and Uncontrolled airspace. Controlled airspace is airspace of defined dimensions within which ATC service is provided to Instrument Flight Rule (IFR) flights and to Visual Flight Rule (VFR) flights in accordance with the airspace classification (Pilot/Controller Glossary [P/CG] 2004). Controlled airspace is categorized into five separate classes: Classes A through E. These classes identify airspace that is controlled, airspace supporting airport operations, and designated airways affording en route transit from place-to-place. The classes also dictate pilot qualification requirements, rules of flight that must be followed, and the type of equipment necessary to operate within that airspace. Elmendorf aircrews fly under FAA rules when not in training airspace.

SUA is designated airspace within which flight activities are conducted that require confinement of participating aircraft, or place operating limitations on non-participating aircraft. Restricted Areas and MOAs depicted on Figure 2.2-2 are examples of SUA.

Other airspace consists of advisory areas, areas that have specific flight limitations or designated prohibitions, areas designated for parachute jump operations, MTRs, and Aerial Refueling Tracks (ARs). This category also includes ATCAAs. When not required for other

3.0 Affected Environment

needs, ATCAA is airspace authorized for military use by the managing ARTCC, usually to extend the vertical boundary of SUA. ATCAAs overlies the MOAs depicted in Figure 2.2-2.

Uncontrolled airspace is designated Class G airspace and has no specific prohibitions associated with its use.

Military training airspace currently used by F-22 aircrews at JBER-Elmendorf includes MOAs, ATCAAs, and Restricted Areas. The F-22s do not train on MTRs. Use of training airspace units is normally scheduled by the owning/using agency, and is managed by the military or the applicable ARTCC.

The following sections discuss the existing SUA that supports F-22 training activity. Refer to Figure 2.2-1 for a depiction of airspace types. Alaskan SUA is managed by the 11th Air Force Commander.

3.1.2.1 Military Operations Area

MOAs are airspace of defined vertical and lateral limits to separate and segregate certain non-hazardous military activities from IFR traffic and to identify for VFR traffic where these activities are conducted (P/CG 2004). MOAs are outside Class A airspace. Class A airspace covers limited parts of Alaska, including the airspace overlying the water within 12 nautical miles (NM) of the coast. Class A airspace extends from 18,000 feet MSL up to and including 60,000 feet MSL (P/CG 2004).

MOAs are considered “joint use” airspace. Non-participating aircraft operating under VFR are permitted to enter a MOA, even when the MOA is active for military use. Aircraft operating under IFR must remain clear of an active MOA unless approved by the responsible ARTCC. Flight in a MOA by both training military and VFR aircraft is conducted under the “see-and-avoid” concept, which stipulates that “when weather conditions permit, pilots operating IFR or VFR are required to observe and maneuver to avoid other aircraft. Right-of-way rules are contained in CFR Part 91” (P/CG 2004). The responsible ARTCC provides separation service for aircraft operating under IFR and MOA participants. The see-and-avoid procedures mean that if a MOA were active during inclement weather, the general aviation pilot could not safely access the MOA airspace.

Table 3.1-1 describes the MOAs used by JBER and other Alaskan military users for flight training.

Aviation and Airspace Use Terminology

Above Ground Level (AGL): Altitude expressed in feet measured above the ground surface.

Mean Sea Level (MSL): Altitude expressed in feet measured above average (mean) sea level.

Flight Level (FL): Manner in which altitudes at 18,000 feet MSL and above are expressed, as measured by a standard altimeter setting of 29.92.

Visual Flight Rules (VFR): A standard set of rules that all pilots, both civilian and military, must follow when not operating under IFRs and in visual meteorological conditions. These rules require that pilots remain clear of clouds and avoid other aircraft.

Instrument Flight Rules (IFR): A standard set of rules that all pilots, civilian and military, must follow when operating under flight conditions that are more stringent than visual flight rules. These conditions include operating an aircraft in clouds, operating above certain altitudes prescribed by FAA regulations, and operating in some locations such as major civilian airports. Air Traffic Control (ATC) agencies ensure separation of all aircraft operating under IFR.

Source: FAA 2004

Table 3.1-1. Description of MOAs

MOA	Altitudes		Hours of Use ¹		Controlling ARTCC
	Minimum	Maximum ²	From	To	
Birch	500 AGL	Up to and including 5,000 MSL	8:00 a.m.	6:00 p.m.	Anchorage
Buffalo	300 AGL	7,000 MSL	8:00 a.m.	6:00 p.m.	Anchorage
Delta	3,000 AGL	FL 180 ³	Only During Major Flying Exercise		Anchorage
Eielson	100 AGL	FL 180	8:00 a.m.	6:00 p.m.	Anchorage
Fox 1	5,000 AGL	FL 180	8:00 a.m.	6:00 p.m.	Anchorage
Fox 2	7,000 MSL	FL 180	8:00 a.m.	6:00 p.m.	Anchorage
Fox 3	5,000 AGL	FL 180	8:00 a.m.	6:00 p.m.	Anchorage
Galena	1,000 AGL	FL 180	8:00 a.m.	6:00 p.m.	Anchorage
Naknek 1	3,000 AGL	FL 180	10:00 a.m.	3:00 p.m.	Anchorage
Naknek 2	3,000 AGL	FL 180	10:00 a.m.	3:00 p.m.	Anchorage
Stony A	100 AGL	FL 180	8:00 a.m.	6:00 p.m.	Anchorage
Stony B	2,000 AGL	FL 180	8:00 a.m.	6:00 p.m.	Anchorage
Susitna	10,000 MSL or 5,000 AGL (whichever is higher)	FL 180	8:00 a.m.	6:00 p.m.	Anchorage
Yukon 1	100 AGL	FL 180	8:00 a.m.	6:00 p.m.	Anchorage
Yukon 2	100 AGL	FL 180	8:00 a.m.	6:00 p.m.	Anchorage
Yukon 3 High	10,000 MSL	FL 180	10:00 a.m.	3:00 p.m.	Anchorage
Yukon 3A Low	100 AGL	10,000 MSL	10:00 a.m. 1:30 p.m.	11:30 a.m. 3:00 p.m.	Anchorage
Yukon 3B	2,000 AGL	FL 180	Only During Major Flying Exercise		Anchorage
Yukon 4	100 AGL	FL 180	10:00 a.m.	3:00 p.m.	Anchorage
Yukon 5	5,000 AGL	FL 180	Only During Major Flying Exercise		Anchorage
Viper ⁴	500 AGL	FL 180	7:00 a.m.	10:00 p.m.	Anchorage

Notes:

1. Days of use are Monday through Friday. All times are local times as normally scheduled.
2. Maximum is up to, but not including unless otherwise noted.
3. Described in terms of hundreds of feet MSL using a standard altimeter setting. Thus, FL180 is approximately 18,000 feet MSL.
4. Viper A/B are divided at 10,000 feet MSL.

FL = Flight Level; AGL = above ground level; MSL = mean sea level

Source: FAA 2009

3.1.2.2 Air Traffic Control Assigned Airspace

An ATCAA is airspace of defined vertical and lateral limits, assigned by ATC, for the purpose of providing air traffic segregation between the specified activities being conducted within the assigned airspace and other IFR air traffic (P/CG 2004). This airspace, if not required for other purposes, may be made available for military use. ATCAAs are often structured and used to extend the horizontal and/or vertical boundaries of SUA such as MOAs and Restricted Areas.

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With the exception of the Buffalo MOA and the Birch MOA, all of the MOAs currently used by JBER aircrews have associated ATCAAs, and ATCAAs not over the MOAs can also be used for training as approved by the FAA. Through letters of agreement with the FAA, ATCAAs may extend up to and above 60,000 feet MSL. Several of the airspace units used by JBER-Elmendorf aircrews are “capped” at lower altitudes by the managing ARTCC to allow unimpeded transit by civil and commercial aircraft traffic.

3.1.2.3 Military Training Route

MTRs are flight corridors developed and used by the DoD to practice high-speed, low-altitude flight, generally below 10,000 feet MSL. No F-22 use of MTRs is proposed. MTRs are airspace of defined vertical and lateral dimensions established for conducting military flight training at airspeeds in excess of 250 knots indicated airspeed (KIAS) (P/CG 2004). MTRs are developed in accordance with criteria specified in FAA Order 7610.4 (DoD 2004). They are described by a centerline, with defined horizontal limits on either side of the centerline, and vertical limits expressed as minimum and maximum altitudes along the flight track. MTRs are identified as Visual Routes (VRs) or Instrument Routes (IRs).

3.1.2.4 Restricted Area

A Restricted Area is designated airspace that supports ground or flight activities that could be hazardous to non-participating aircraft. A Restricted Area is designated under 14 CFR Part 73, within which the flight of non-participating aircraft, while not wholly prohibited, is subject to restriction. Most Restricted Areas are designated “joint-use” and IFR/VFR operations in the area may be authorized by the controlling ATC facility when the airspace is not being utilized by the using agency. The Restricted Areas, R-2202, R-2203, and R-2205, are Army ranges used by the Air Force for training. R-2206 is not a flying range (see Figure 2.2-3). R-2211 is Air Force-managed airspace to support training activities. According to FAA Order 7400.8M, R-2202C is between 10,000 and 29,000 feet MSL and R-2202D is 31,000 feet MSL to unlimited. These airspaces are described in Table 3.1-2.

Range management involves the development and implementation of those processes and procedures required by AFI 13-212, Volumes 1, 2, and 3, to ensure that Air Force ranges are planned, operated, and managed in a safe manner; that all required equipment and facilities are available to support range use; and that proper security for range assets is present. Specific direction on different range activities is contained in AFI 13-212, Volume 1, *Range Planning and Operations*, Volume 2, *Range Construction and Maintenance*, and Volume 3, *SAFE-RANGE Program Methodology* (Air Force 2001c, 2001d, 2001e). The focus of range management is on ensuring the safe, effective, and efficient operation of Air Force ranges. The overall purpose of range management is to balance the military’s need to accomplish realistic testing and training with the need to minimize potential impacts of such activities on the environment and surrounding communities (Air Force 2001c, 2001d, 2001e).

Table 3.1-2. Description of Restricted Airspace

Restricted Area	Altitudes		Hours of Use ¹		Controlling ARTCC
	Minimum	Maximum	From	To	
R-2202A	Surface	9,999 MSL ²	6:00 a.m.	5:00 p.m.	Anchorage
R-2202B	Surface	9,999 MSL	6:00 a.m.	5:00 p.m.	Anchorage
R-2202C/D	10,000 MSL	Unlimited	By Notice to Airmen	Scheduled by Agreement	Anchorage
R-2203A ³	Surface	11,000 MSL	5:00 a.m.	12:00 p.m.	Anchorage
R-2203B ³	Surface	11,000 MSL	5:00 a.m.	12:00 p.m.	Anchorage
R-2203C ³	Surface	5,000 MSL	5:00 a.m.	12:00 p.m.	Anchorage
R-2205	Surface	20,000 MSL	6:00 a.m.	6:00 p.m.	Fairbanks Approach
R-2206 ⁴	Surface	8,800 MSL	Continuous	Continuous	Anchorage
R-2211	Surface	18,000 MSL	7:00 a.m.	5:00 p.m.	Anchorage

Notes:

1. Days of use are Monday through Friday. All times are local times as normally scheduled.
2. MSL = Feet above mean sea level.
3. Ranges are not expected to be used by the F-22.
4. Not used for flight training.

3.2 Noise

This section describes existing conditions in the area immediately surrounding JBER-Elmendorf (as identified by the 65 dB Day-Night Average Sound Levels [L_{dn}] noise contour) and in military training airspace units that would be used by the additional F-22 aircraft.

Noise is considered to be unwanted sound that interferes with normal activities or otherwise diminishes the quality of the environment. The noise may be intermittent or continuous, stationary or transient. Stationary sources are normally related to specific land uses, e.g., housing tracts or industrial plants. Transient noise sources move through the environment, either along established paths (e.g., highways, railroads), or randomly (e.g., an aircraft flying in a block of training airspace such as a MOA). Noise may be steady, increasing and decreasing gradually, or impulsive, increasing and decreasing suddenly (e.g., clapping or banging such as thunder or sonic booms). There is wide diversity in responses to noise that not only vary according to the type of noise and the characteristics of the sound source, but also according to the sensitivity and expectations of the receptor, the time of day, and the distance between the noise source (e.g., an aircraft) and the receptor (e.g., a person or animal).

3.2.1 Noise Characteristics and Measures

The physical characteristics of noise, or sound, include its *intensity*, *frequency*, and *duration*. Sound is created by acoustic energy, which produces minute pressure waves that travel through a medium, like air, and are sensed by the eardrum. This may be likened to the ripples in water that would be produced when a stone is dropped into it. As the acoustic energy increases, the intensity or amplitude of these pressure waves increase, and the ear senses louder noise. Sound intensity varies widely (such as from a soft whisper to a jet engine) and is measured on a logarithmic scale to accommodate this wide range. The use of logarithms is nothing more than a mathematical tool that simplifies dealing with very large and very small numbers. For

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example, the logarithm of the number 1,000,000 is 6, and the logarithm of the number 0.000001 is -6 (minus 6). Obviously, as more zeros are added before or after the decimal point, converting these numbers to their logarithms greatly simplifies calculations that use these numbers.

Sound intensity in air is expressed slightly differently than sound intensity underwater. Sound intensity relates to the ratio of the pressure level that is the sound to a reference pressure level. By convention, the sound levels in air are referenced to 20 μPa (re 20 μPa) and sound levels in water are referenced to 1 μPa . In this EA, all sound levels in air can be assumed to be re 20 μPa and sound levels in water can be assumed to be re 1 μPa .

The frequency of sound is measured in cycles per second, or hertz (Hz). This measurement reflects the number of times per second the air vibrates from the acoustic energy. Low frequency sounds are heard as rumbles or roars, and high frequency sounds are heard as screeches. Sound measurement is further refined through the use of “A-weighting.” The normal human ear can detect sounds that range in frequency from about 20 Hz to 15,000 Hz. However, all sounds throughout this range are not heard equally well. Therefore, through internal electronic circuitry, some sound meters are calibrated to emphasize frequencies in the 1,000 to 4,000 Hz range. The human ear is most sensitive to frequencies in this range, and sounds measured with these instruments are termed “A-weighted,” and are shown in terms of A-weighted decibels. “C-weighting” is a frequency-weighting scale which does not de-emphasize low-frequency sounds as much as the A-weighting scale. C-weighting is typically used to describe impulsive sounds such as clapping, thunder, or sonic booms that are felt as well as heard. Un-weighted sound levels are typically used when the responsiveness of the noise receptor to noise is variable or not well understood. For example, un-weighted sound levels are used when assessing noise impacts on marine mammals.

The duration of a noise event, and the number of times noise events occur are also important considerations in assessing noise impacts.

The word “metric” is used to describe a standard of measurement. As used in environmental noise analysis, there are many different types of noise metrics. Each metric has a different physical meaning or interpretation and each metric was developed by researchers attempting to represent the effects of environmental noise. The metrics that support the assessment of noise from aircraft operations associated with the proposal include the maximum sound level (L_{max}), the Sound Exposure Level (SEL), L_{dn} , and the Sound Pressure Level (SPL). These metrics are discussed briefly below and in greater detail in Appendix D.

3.2.1.1 Maximum Sound Level

L_{max} defines peak noise levels. L_{max} is the highest sound level measured during a single noise event (e.g., an aircraft overflight), and is the sound actually heard by a person on the ground. For an observer, the noise level starts at the ambient noise level, rises up to the maximum level as the aircraft flies closest to the observer, and returns to the ambient level as the aircraft recedes into the distance. In this EA, L_{max} is always A-weighted, stated re 20 μPa , and used to describe sound levels in air.

3.2.1.2 Sound Exposure Level

L_{\max} alone may not represent how intrusive an aircraft noise event is because it does not consider the length of time that the noise persists. The SEL metric combines both of these characteristics into a single measure. It is important to note, however, that SEL does not directly represent the sound level heard at any given time, but rather provides a measure of the total exposure of the entire event. Its value represents all of the acoustic energy associated with the event, as though it were present for one second. Therefore, for sound events that last longer than one second, the SEL value will be higher than the L_{\max} value. The SEL value is important because it is the value used to calculate other time-averaged noise metrics. In this EA, all stated SEL values are A-weighted, stated re 20 μPa , and used to describe sound levels in air.

3.2.1.3 Sound Pressure Level

The SPL metric, which is used to assess impacts to aquatic animals, simply states the un-weighted sound intensity at a particular time. In this EA, SPL levels are used to describe peak noise level in water (re 1 μPa) associated with aircraft overflights and ambient noise levels underwater.

3.2.1.4 Time-Averaged Cumulative Day-Night Average Noise Metrics

The number of times aircraft noise events occur during given periods is also an important consideration in assessing noise impacts. The “cumulative” noise metrics that support the analysis of multiple time-varying aircraft events are L_{dn} and the Onset-Rate Adjusted Monthly Day-Night Average Sound Level (L_{dnmr}).

These metrics sum the individual noise events and average the resulting level over a specified length of time. Thus, L_{dn} and L_{dnmr} are composite metrics representing the maximum noise levels, the duration of the events, the number of events that occur, and the time of day during which they occur. These metrics add a ten decibel (dB) penalty to those events that occur between 10:00 p.m. and 7:00 a.m. to account for the increased intrusiveness of noise events that occur at night when ambient noise levels are normally lower than during the daytime. L_{dnmr} adds to the L_{dn} metric the startle effects of an aircraft flying low and fast where the sound can rise to its maximum very quickly. Because the tempo of operations is so variable in airspace units, L_{dnmr} is calculated based on the average number of operations per day in the busiest month of the year.

L_{dn} and L_{dnmr} may be thought of as the continuous or cumulative A-weighted sound level which would be present if all of the variations in sound level which occur over the given period were smoothed out so as to contain the same total sound energy. These cumulative metrics do not represent the variations in the sound level heard. For example, an L_{dn} of 65 dB could result from a very few noisy events, or a large number of less noisy events. Nevertheless, they do provide an excellent measure for comparing environmental noise exposures when there are multiple noise events to be considered.

Studies of community annoyance caused by numerous types of environmental noise show that $L_{\text{dn}}/L_{\text{dnmr}}$ correlates well with effects, and Schultz (1978) showed a consistent relationship between noise levels and annoyance (Table 3.2-1). A more recent study reaffirmed and updated

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this relationship (Fidell *et al.* 1991). The updated relationship, which does not differ substantially from the original, is the current preferred form (see Appendix D). The correlation between L_{dn}/L_{dnmr} is weaker for the annoyance of individuals. This is not surprising considering the varying personal factors that influence the manner in which individuals react to noise. The inherent variability between individuals makes it impossible to predict accurately how any individual will react to a given noise event. Nevertheless, findings substantiate that community annoyance to aircraft noise is represented quite reliably using L_{dn} . Use of the L_{dn} metric to predict human annoyance to noise has been endorsed by the scientific community and governmental agencies (American National Standards Institute 1980, 1988; USEPA 1974; Federal Interagency Commission on Urban Noise 1980; Federal Interagency Commission on Noise 1992).

Table 3.2–1. Relation Between Annoyance and L_{dn}

L_{dn} (dB)	CDNL (dB)	Average Percentage of Highly Annoyed Population
55	52	3.3
60	57	6.5
65	61	12.3
70	65	22.1
75	69	36.5

Source: Fidell *et al.* 1991, Committee on Hearing Bioacoustics and Biomechanics 1981; Schultz 1978, Stusnick *et al.* 1992.

Community effects from sonic booms, in the form of annoyance, correlates well with the C-weighted Day-Night Average Noise Level (CDNL) (see Table 3.2-1). CDNL is similar to L_{dn} , but uses C-weighting to account for the low frequency impulsive nature of sonic booms. Interpretation of CDNL uses a slightly different relation than interpretation of L_{dn} , with a given numeric value of CDNL generally representing more annoyance than the same numeric value of L_{dn} . In this EA, L_{dn} noise levels can be assumed to be A-weighted unless specifically designated as being C-weighted.

3.2.2 Base Existing Conditions

This section describes existing noise conditions in land areas near JBER as well as in the Knik Arm, which is located to the west and north of the installation. The CIBW has recently been listed as endangered under Section 7 of the Endangered Species Act. This section will provide description of the baseline noise environment in the Knik Arm to facilitate assessment of noise impacts to the CIBW and other wildlife in the Knik Arm associated with the Proposed Action. Additional discussion of baseline and proposed noise levels on biological resources in the Knik Arm can be found in section 3.6 and 4.6 (Biological Resources).

3.2.2.1 Land Areas

JBER-Elmendorf has supported a variety of aircraft and operations since its inception in the early 1940s. Aircraft and associated missions have ranged from World War II bombers and cargo aircraft to the current suite of F-22, C-17, E-3, C-12, and C-130 aircraft. The variety of missions and aircraft over the years has formed the shape and extent of areas affected by aircraft operations and associated noise.

Baseline noise levels, expressed as L_{dn} , were modeled based on aircraft types, runway use patterns, engine power settings, altitude profiles, flight track locations, airspeed, and other factors. To identify the areas affected by noise levels around the base, the Air Force's NOISEMAP program was used. Noise levels were calculated for the average operational day. Under the average operational day concept, annual flying operations are averaged over the number of days which the unit actually operates. Then, the Air Force's NMPlot program is used to graphically plot these contours on a background map in 5 dB increments from 65 L_{dn} to 85 L_{dn} . In keeping with JBER-Elmendorf noise abatement programs, no sorties by fighter aircraft are assumed to occur between 10 p.m. and 7 a.m. for normal training activity. The baseline noise contours depicted in Figure 3.2-1 reflect aircraft operations data collected by the Air Force Center for Engineering and the Environment through unit interviews held in August 2009. F-22 and C-17 flying operations data were updated based on pilot interviews held in December 2010 and March 2011.

Noise levels of 65 L_{dn} or greater mostly affect lands on JBER. Off-base areas affected by noise levels of 65 L_{dn} or higher occur over the Knik Arm and, to a small degree, the industrial Port of Anchorage, and to a smaller degree land west of the Knik Arm. Table 3.2-2 details the extent of these areas exposed to elevated noise levels. Section 4.8 describes the land use implications of these noise levels.

Table 3.2-2. Land Area Noise Exposures Under Baseline Conditions

Location	Area (In Acres) Exposed to					
	Indicated Noise Levels (In L_{dn})					
	65-70	70-75	75-80	80-85	>85	Total
JBER	5,534.7	2,374.2	1,009.7	496.4	457.0	9,872.0
Knik Arm/Cook Inlet (Water)	3,062.5	465.6	47.0	0.0	0.0	3,575.1
Port of Anchorage	42.2	11.8	4.6	0.0	0.0	58.6
Land West of Knik Arm	0.5	0.0	0.0	0.0	0.0	0.5
Total	8,639.9	2,842.6	1,061.3	496.4	457.0	13,506.2

Figure 3.2-1 shows land uses on JBER in relation to baseline noise contours. Land uses are generalized as administrative/industrial, community support, and residential, which are relatively noise-sensitive land uses. Other land uses on JBER, such as open land, range areas, and airfield pavements, are not as noise-sensitive and are not shown on the map. Total acreage affected by greater than 65 L_{dn} in administrative/industrial, community support, and residential land use categories is listed in Table 3.2-3. In relatively rare instances where a particular parcel of land had two designated land uses (e.g., residential and community support), the land area was counted towards the total acreage for both categories. This approach avoids under representing impacts to relatively noise sensitive land uses. The effects of aircraft noise at residences are of particular concern, because background noise levels are often low and because sleep, relaxation, and other activities common in a residential environment are easily disturbed by noise. Under baseline conditions, 157 residential structures on JBER are exposed to noise greater than 65 L_{dn} .

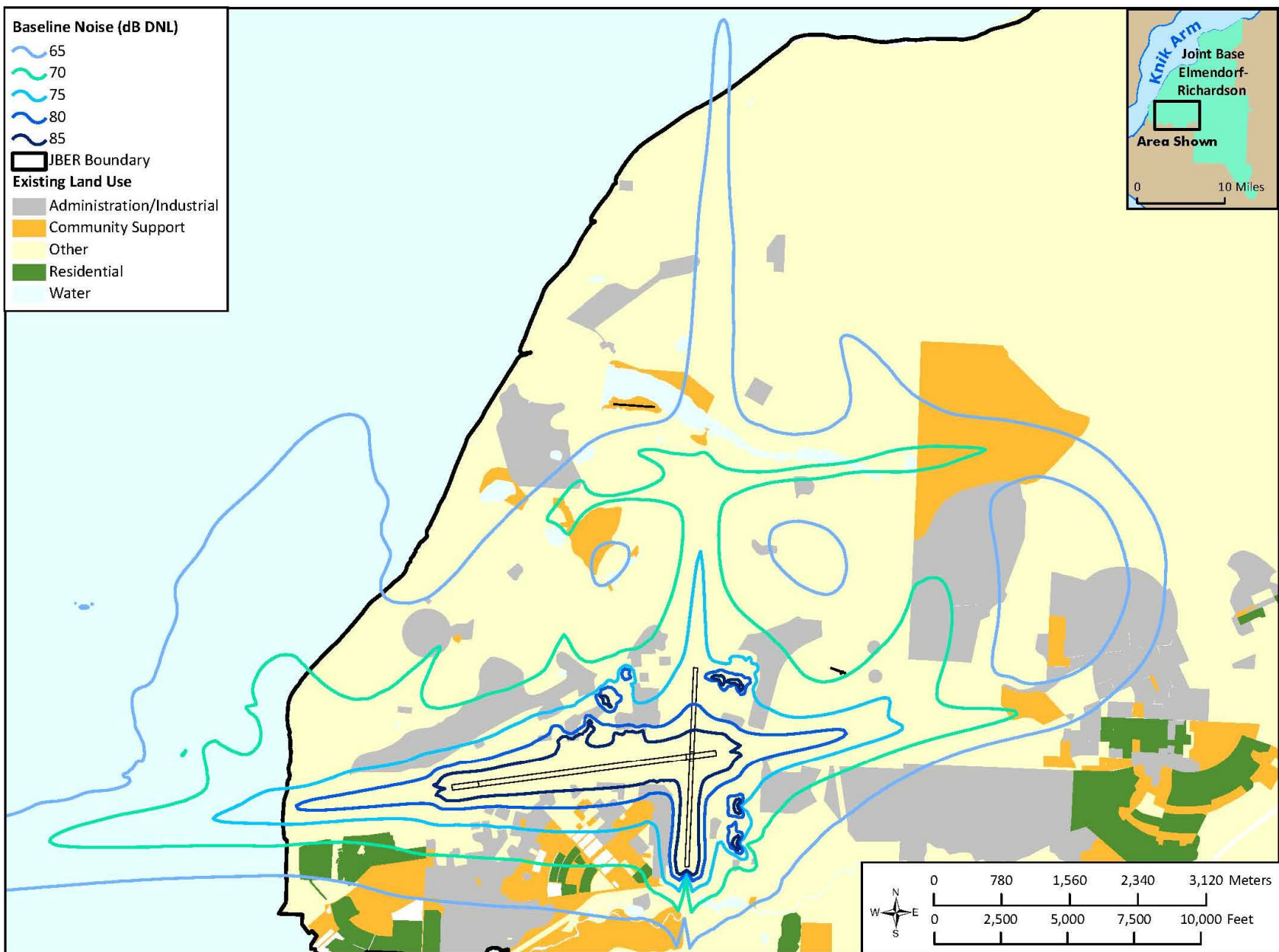


Figure 3.2-1. Land Use in Relation to Baseline Noise Contours

Table 3.2-3. Acres on JBER in Several Land Use Categories Impacted by Noise Greater Than 65 L_{dn}

<i>Land Use Category</i>	<i>Acres ≥ 65 dB L_{dn}</i>
Administrative/ Industrial	2,040
Community Support	817
Residential (Accompanied and Unaccompanied)	199

Due to climactic conditions in Alaska, structures on JBER are designed to avoid any unnecessary heat loss. Measures taken to avoid heat loss (e.g., thicker insulation, double-paned windows, etc.) also result in improved exterior-to-interior noise attenuation. The average exterior-to-interior noise level reduction provided by a typical American home located in a cold climate is 27 dB, if the windows are closed and 17 dB if the windows are open (USEPA 1974). Noise attenuation provided by non-residential structures on JBER varies widely based on structure type. However, most structures on JBER that are frequently occupied are also designed with energy-efficient construction elements and therefore high levels of structural noise attenuation. As a result of structural noise attenuation, persons indoors experience substantially lower noise levels than persons outdoors, and the likelihood of noise-related annoyance is commensurately lower.

While some persons on JBER would be expected to be annoyed by aircraft noise, the percentage of the affected persons annoyed would probably not be as high as predicted using the relationship between L_{dn} and annoyance described in Table 3.2-1. Noise is a highly subjective phenomenon, and the likelihood of annoyance is strongly linked to characteristics of the listener, including the attitude of the listener towards the noise source. As most of the persons on base are either directly or indirectly employed by the military, their attitude towards the military is generally assumed to be positive.

There are situations where noise in certain locations on JBER may exceed levels at which long-term noise-induced hearing loss is possible. At JBER-Elmendorf, the hearing conservation program is conducted in accordance with Air Force Occupational Safety and Health (AFOSH) Standard 48-20, *Occupational Noise and Hearing Conservation Program*, DoD Instruction 6055.12, *DoD Hearing Conservation Program*, and 29 Code of Federal Register 1910.95, *Occupational Noise Exposure*. The DoD, U.S. Air Force, and the National Institute of Occupational Safety and Health (NIOSH) have all established occupational noise exposure damage risk criteria (or “standards”) for hearing loss so as to not exceed 85 dB as an 8-hour time weighted average, with a 3 dB exchange rate in a work environment. The exchange rate is an increment of decibels that requires the halving of exposure time, or a decrement of decibels that requires the doubling of exposure time. For example, a 3 dB exchange rate requires that noise exposure time be halved for each 3 dB increase in noise level. Therefore, an individual would achieve the limit for risk criteria at 88 dB, for a time period of four hours, and at 91 dB, for a time period of two hours. The standard assumes “quiet” (where an individual remains in an environment with noise levels less than 72 dB) for the balance of the 24-hour period. Also, Air Force and Occupational Safety and Health Administration (OSHA) occupational standards prohibit any unprotected worker exposure to continuous (i.e., of a duration greater than one second) noise exceeding a 115 dB sound level. OSHA established this additional standard to reduce the risk of workers developing noise-induced hearing loss.

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The Hearing Conservation Program at JBER is administered by the Bioenvironmental Engineering Office. As per the requirements of AFOSH Standard 48-20, representatives from the Bioenvironmental Engineering Office visit facilities in which workers could potentially be expected to be exposed to noise levels exceeding noise exposure thresholds. A health risk assessment is conducted in those facilities and, as part of the assessment, a representative sample of employees are instructed to carry noise dosimeters for a specified period of time. If noise exposure exceeds established thresholds, then an audiometric monitoring program is initiated. Workers in known high noise exposure locations may be required to wear hearing protection devices including but not limited to ear plugs and ear muffs. If noise exposure thresholds are not exceeded, then a schedule is established for return visits to the facility to repeat testing to confirm that conditions have not changed.

DoD policy for assessing hearing loss risk pursuant to NEPA is to use the 80 L_{dn} noise contour to identify populations at the most risk of potential hearing loss (Undersecretary of Defense for Acquisition, Technology and Logistics 2009). Fifty-two structures, which are all located on JBER near the flightline, are currently within the 80 L_{dn} contour. The majority of the structures are manned and, as such, employees working in these buildings are subject to occupational noise exposure laws and regulations as described above. The JBER Bioenvironmental Engineering Office considers several factors, including structural noise attenuation and the amount of time workers spend outside when deciding on the appropriate course of action with regards to implementation of the Hearing Conservation Program.

Aircraft at JBER-Elmendorf generally operate according to established flight paths and overfly the same areas surrounding the base. Military aircraft are designed for performance, and the engines are noisy. JBER-Elmendorf employs a quiet-hours program in which, barring a national emergency or a major exercise, fighter aircraft operations (takeoff and landing patterns as well as engine run-ups) are avoided after 10:00 p.m. and before 7:00 a.m. every day of the week. At JBER-Elmendorf, noise exposure from airfield operations typically occurs beneath approach and departure corridors along both the main and crosswind runways and in areas immediately adjacent to parking ramps and aircraft staging areas.

3.2.2.2 Noise Levels in the Knik Arm

Ambient noise levels in the Knik Arm are relatively high due to noise generated in the Port of Anchorage and other anthropogenic noise sources and may meet or exceed the basement threshold for behavioral harassment of beluga whales as published by NMFS (120 dB re 1 μ Pa for non-impulse sound). High measured noise levels in the Knik Arm are attributed primarily to strong tidal flow, intense wind and wave action, and sounds generated in the Port of Anchorage. In a paper published in 2002, Blackwell and Greene reported in-water noise levels averaging 119 dB SPL adjacent to Elmendorf AFB while no overflights were taking place. The same paper reported measured ambient noise of 124 dB re 1 μ Pa at the nearby Point Possession during a changing tide. More recently, KABATA *et al.* (2010) summarized a variety of existing noise studies conducted within the Knik Arm and concluded that measured background levels rarely are below 125 dB re 1 μ Pa, except in conditions of no wind and slack tide. Ambient noise energy in the Knik Arm is typically concentrated at frequencies below 10 Kilohertz (kHz) (Blackwell and Greene 2002). Beluga hearing is not thought to be particularly acute at frequencies at or below 10 kHz (Richardson *et al.* 1995).

During F-22 overflight, calculated noise levels in the Knik Arm increase from ambient levels to up to 137 dB SPL in limited areas during the brief period of overflight. As a point of reference, maximum estimated F-22 noise levels are slightly higher than measured F-15 overflight in-water noise levels of 134 dB SPL measured by Blackwell and Greene. These noise levels are well below the threshold for physical harm, but exceed the basement threshold for behavioral harassment.

A detailed analysis was conducted on potential effects of F-22 flying operations noise on the CIBW. The analysis, which is discussed in greater detail in Section 4.6 (Biological Resources) and Appendix E, *Section 7 (Endangered Species Act) Compliance Wildlife Analysis for F-22 Plus Up Environmental Assessment*, took into account the following factors, including:

- Area affected by several noise level intervals with potential to negatively affect the CIBW associated with each F-22 flight profile type;
- Estimated average number of CIBW individuals per unit area;
- The probability of behavioral harassment associated with each noise level;
- The frequency of events; and,
- The duration of events.

While noise levels generated during F-22 overflight do have the potential to result in CIBW behavioral harassment, the probability of behavioral harassment at these noise levels is low. Based on the factors listed above, it was found that behavioral harassment events associated with the proposed additional F-22 overflights are expected to be relatively rare (approximately 0.04 behavioral harassment events per year).

3.2.3 Training Airspace Existing Conditions

This section describes noise levels associated with subsonic and supersonic aircraft operations in the training airspace.

3.2.3.1 Subsonic Flight

Within MOAs and overlying ATCAAs, subsonic training flights are dispersed and distributed throughout the training airspace. The Air Force has developed the MR_NMAP (MOA-Range NOISEMAP) computer program (Lucas and Calamia 1996) to calculate subsonic aircraft noise in these areas. This computer program calculates estimated noise levels based on aircraft type, flight characteristics, meteorological conditions, and training activities. The model results are supported by measurements in several military airspaces (Lucas *et al.* 1995). The L_{dnmr} noise level has been computed for each of the primary airspace units potentially affected by the Proposed Action. As discussed in Section 3.2.1.4, time-averaged cumulative noise metrics, such as L_{dnmr} represent the most widely accepted method of quantifying noise impact. However, they do not provide an intuitive description of the noise environment and people often desire to know what the loudness of an individual aircraft will be. MR_NMAP and its supporting programs can provide L_{max} (Table 3.2-4) and SEL (Table 3.2-5) at various distances and altitudes.

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Table 3.2-4. Maximum Noise Level (Lmax) Under the Flight Track for Aircraft at Various Altitudes in the Primary Airspace¹

<i>Aircraft Type</i>	<i>Airspeed</i>	<i>Power Setting²</i>	<i>300 AGL</i>	<i>500 AGL</i>	<i>1,000 AGL</i>	<i>2,000 AGL</i>	<i>5,000 AGL</i>	<i>10,000 AGL</i>	<i>20,000 AGL</i>
F-15C	520	81% NC	119	114	107	99	86	74	57
F-22	450	70% ETR	120	115	108	100	88	78	66
F-16A	450	87% NC	112	108	101	93	80	67	50
F-18A	500	92% NC	120	116	108	99	85	71	54
B-1B	550	101% RPM	117	112	106	98	86	75	61

Notes:

1. Level flight, steady, high-speed conditions.
2. Engine power setting while in a MOA. The type of engine and aircraft determines the power setting.
3. RPM = rotations per minute, NC = percent core RPM, and ETR = engine thrust request.
AGL = above ground level

Table 3.2-5. Sound Exposure Level (SEL) under the Flight Track for Aircraft at Various Altitudes in the Primary Airspace¹

<i>Aircraft Type</i>	<i>Airspeed</i>	<i>300 AGL</i>	<i>500 AGL</i>	<i>1,000 AGL</i>	<i>2,000 AGL</i>	<i>5,000 AGL</i>	<i>10,000 AGL</i>	<i>20,000 AGL</i>
F-15C	520	116	112	107	101	91	80	65
F-22	450	120	116	111	105	95	86	76
F-16A	450	110	107	101	95	85	74	59
F-18A	500	118	114	108	101	89	77	62
B-1B	550	116	112	107	101	92	82	70

Notes:

1. Level flight, steady, high-speed conditions.
2. AGL = above ground level

Table 3.2-6 shows the baseline noise levels beneath the training airspace units. Cumulative noise levels in all airspace units are 58 L_{dnmr} or less. Noise levels below 45 L_{dnmr} are presumed to be approximately at ambient levels and are shown in Table 3.2-6 as "<45".

Table 3.2-6. Baseline Noise Levels Beneath Training Airspace Units

<i>MOA/ATCAA</i>	<i>L_{dnmr} (dB)</i>	<i>CDNL (dB)</i>	<i>Supersonic Events/Month</i>	<i>Booms/Month (at ground)</i>
Galena ¹	<45	N/A	N/A	N/A
Naknek 1/2 ¹	<45	41	3.6	1.5
Stony A/B ²	52	52	43.2	18.1
Susitna ³	<45	N/A	N/A	N/A
Delta	<45	50	23.8	10
Eielson ¹	58	54	63	26.5
Fox 1/2/3 ⁵	51	54	63	26.5
Yukon 1 ⁵	45	51	35	14.7
Yukon 2 ⁵	45	50	28.4	11.9
Yukon 3 ⁵	44	50	26	10.9
Yukon 4 ⁵	45	49	25.3	10.6
Yukon 5 ⁵	44	50	24.4	10.3
Viper ⁴	56	N/A	N/A	N/A

Notes:

1. ATCAAs supersonic approved above 30,000 MSL.
2. Supersonic approved above 10,000 MSL or 5,000 AGL (whichever is higher).
3. Supersonic approved ONLY for Functional Check Flights above 12,000 MSL or 5,000 AGL (whichever is higher) on an East-West line south of Denali Reserve.
4. Supersonic not approved.
5. Supersonic approved above 12,000 MSL or 5,000 AGL (whichever is higher).

3.2.3.2 Supersonic Flight

Table 3.2-6 also presents baseline noise levels associated with supersonic flight.

Supersonic flight for fighter aircraft is primarily associated with air combat training. Supersonic activity is authorized in the MOAs under specific altitude restrictions. Supersonic flight produces an air pressure wave that may reach the ground as a sonic boom. The amplitude of an individual sonic boom is measured by its peak overpressure (PSF), in pounds per square foot (psf) and depends on an aircraft's size, weight, geometry, Mach number, and flight altitude. Table 3.2-7 shows sonic boom overpressures for the F-15, F-16, and F-22 aircraft in level flight at various conditions. The biggest single condition affecting overpressure is altitude. Maneuvers can also affect boom PSFs, increasing or decreasing overpressures from those shown in Table 3.2-7. A focus boom may result when maneuvers at supersonic speeds focus the peak overpressure. Appendix D explains the different types of supersonic events.

Table 3.2-7. Sonic Boom Peak Overpressures (psf) for F-15 and F-22A Aircraft at Mach 1.2 Level Flight¹

Aircraft	Altitude (feet)		
	10,000	20,000	30,000
F-22	6.2	3.2	2.1
F-16	4.9	2.5	1.6
F-15	6.4	3.3	2.2

Note:

Calculated using CABOOM; Focusing can result in overpressures increased by two to five times the steady state boom levels; Boom levels diminish toward 0.1 psf as the lateral distance increases

Aircraft exceeding Mach 1 always create a sonic boom, although not all supersonic flight activities will cause a boom at the ground. As altitude increases, air temperature decreases, and the resulting layers of temperature change causing booms to be turned upward as they travel toward the ground. Depending on the altitude of the aircraft and the Mach number, many sonic booms are bent upward sufficiently that they never reach the ground. This same phenomenon, referred to as "cutoff," also acts to limit the width (area covered) of the sonic booms that reach the ground (Plotkin *et al.* 1989).

When a sonic boom reaches the ground, it impacts an area which is referred to as a "footprint" or (for sustained supersonic flight) a "carpet." The size of the footprint depends on the supersonic flight path and on atmospheric conditions. Sonic booms are loudest near the center of the footprint, with a sharp "bang-bang" sound. Near the edges, they are weak and have a rumbling sound like distant thunder.

Sonic booms from air combat training activity tend to be concentrated within elliptical boundaries fitting within the MOA/ATCAA. Aircraft will set up at positions up to 100 nautical miles apart before proceeding toward each other for an engagement. The airspace used tends to be aligned, connecting the setup points in an elliptical shape. Aircraft will fly supersonic at various times during an engagement exercise. Supersonic events can occur as the aircraft accelerate toward each other, during dives in the engagement itself, and during disengagement. The long-term average sonic boom patterns also tend to be elliptical and this is reflected by the spatial distribution of CDNL noise levels.

Long-term sonic boom measurement projects have been conducted in four airspaces: White Sands, New Mexico (Plotkin *et al.* 1989); the eastern portion of the Goldwater Range, Arizona (Plotkin *et al.* 1992); the Elgin MOA at Nellis AFB, Nevada (Frampton *et al.* 1993); and the western portion of the Goldwater Range (Page *et al.* 1994). These studies included analysis of

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schedule and air combat maneuvering instrumentation data, and they supported development of the 1992 BOOMAP model (Plotkin *et al.* 1992). The current version of BOOMAP (Frampton *et al.* 1993; Plotkin 1996) incorporates results from all four studies. Because BOOMAP is directly based on long-term measurements, it implicitly accounts for maneuvers, statistical variations in operations, atmospheric effects and other factors.

A variety of aircraft conducting training perform flight activities that include supersonic events. For most fighter aircraft, these events occur during air-to-air combat, often at high altitudes. Table 3.2-5 shows baseline supersonic noise levels (CDNL) as generated using BOOMAP. Table 3.2-5 also provides the estimated number of supersonic flight events, and the number of sonic booms that effect any given location on the ground near the center of each airspace unit. Individual sonic boom footprints could affect areas from about 10 square miles to 100 square miles.

Training F-22s are estimated to be training at supersonic speeds more than three times as much as aircraft such as the F-15C. This means that the F-22 is supersonic approximately 25 percent of an engagement versus 7.5 percent for an F-15C (see Section 2.2). For example, during a typical 14 minute air-to-air engagement, the F-22 could be supersonic approximately 3 to 6 minutes, while the F-15C could be supersonic approximately 1 to 2 minutes. Depending on altitude and meteorological conditions, an existing F-22 supersonic flight can create a carpet boom which travels with the aircraft and is experienced under the training airspace. Individual focus booms with higher overpressures can be created during supersonic maneuvers. Appendix D explains the carpet and focus booms associated with supersonic training. A carpet boom extends over a broad area, although it does not continuously affect any specific location. So the number of booms experienced on the ground at any location would be based on the duration of supersonic flight, not whether the supersonic flight occurred in a series of supersonic dashes from an F-16 or F-15 or from an F-22 flying at supersonic speed for a longer period of time. Focus boom concern is somewhat reduced due to the typical population density of less than 0.1 person per square mile under the Alaskan training airspace.

3.3 Safety

The ground, flight, and explosive safety ROI includes activities and operations conducted on the base itself, as well as training conducted in Alaskan military training airspace. Ground safety considers issues associated with operations and maintenance activities that support base operations, including fire response. Flight safety considers aircraft flight risks. Explosive safety discusses the management and use of ordnance or munitions associated with airbase operations and training activities conducted in various elements of training airspace.

3.3.1 Base Existing Conditions**3.3.1.1 Ground Safety**

Ongoing F-22 operations and maintenance activities conducted by the 3 WG are performed in accordance with applicable Air Force safety regulations, published Air Force Technical Orders, and standards prescribed by Air Force Occupational Safety and Health requirements. The 3 WG fire department provides fire and crash response at JBER-Elmendorf. The unit has a sufficient number of trained and qualified personnel, and the unit possesses all equipment

necessary to respond to aircraft accidents and structure fires. There are no response-equipment shortfalls.

Clear Zones (CZs), Accident Potential Zones (APZs), and safety zones have been established around the airfield to minimize the results of a potential accident involving aircraft operating from JBER-Elmendorf. These zones are shown in Figure 3.3-1 from the 2005 Base General Plan. The CZ is an area 3,000 feet wide by 3,000 feet long and is located at the immediate end of the runway. The accident potential in this area is so high that no building is allowed. APZ I is a 3,000-foot wide by 5,000 foot-long area located just beyond the CZ with a high potential for accidents. A portion of the Mountain View community is within APZ 1. Land uses that concentrate people in small areas are not compatible with APZ I (Air Force Civil Engineer Support Agency, U.S. Army Corps of Engineers [USACE], and Naval Facilities Engineering Command 2001). APZ II is an area 3,000 feet wide by 7,000 feet long beyond APZ I, and high density functions such as multistory buildings, places of assembly (e.g., theaters, schools, churches and restaurants) and high density office uses are not considered compatible with APZ II (Air Force Civil Engineer Support Agency, USACE, and Naval Facilities Engineering Command 2001). Unified Facilities Criteria 3-260-01 also specifies encroachment-free standards along and on either side of the runway (Air Force Civil Engineer Support Agency, USACE, and Naval Facilities Engineering Command 2001).

As of 2006, the JBER-Elmendorf runways were operating under waivers and exemptions to these criteria (see Table 3.3-1).

Table 3.3-1. Airfield Waivers and Exemptions

<i>Type</i>	<i>Number For Specified Types</i>		
	Clear Zone	Accident Potential Zone	Other
Waivers	5	1	60
Exemptions	4	--	25
Deviation	--	--	24

Source: Personal communication, Dougan 2011

3.3.1.2 Flight Safety

The typical public concern with regard to flight safety is the potential for aircraft accidents. Such mishaps may occur as a result of weather-related accidents, mechanical failure, pilot error, mid-air collisions, collisions with manmade structures or terrain, or bird-aircraft collisions. Flight risks apply to all aircraft; they are not limited to the military.

The Air Force defines four major categories of aircraft mishaps: Classes A, B, C, and E. Class A mishaps result in a loss of life, permanent total disability, a total cost in excess of \$2 million, or destruction of an aircraft. Class B mishaps result in total costs of more than \$500,000 but less than \$2 million, permanent partial disability, or inpatient hospitalization of three or more personnel. Class C mishaps involve reportable damage of more than \$50,000, but less than \$500,000; an injury resulting in any loss of time from work beyond the day or shift on which it occurred, or occupational illness that causes loss of time from work at any time; or an occupational injury or illness resulting in permanent change of job. Class E mishaps are minor, up to less than \$50,000 (Air Force Safety, Health, and Environmental Standard A2 (Air Force 2010c). This EA will focus on Class A mishaps because of their potentially catastrophic results.

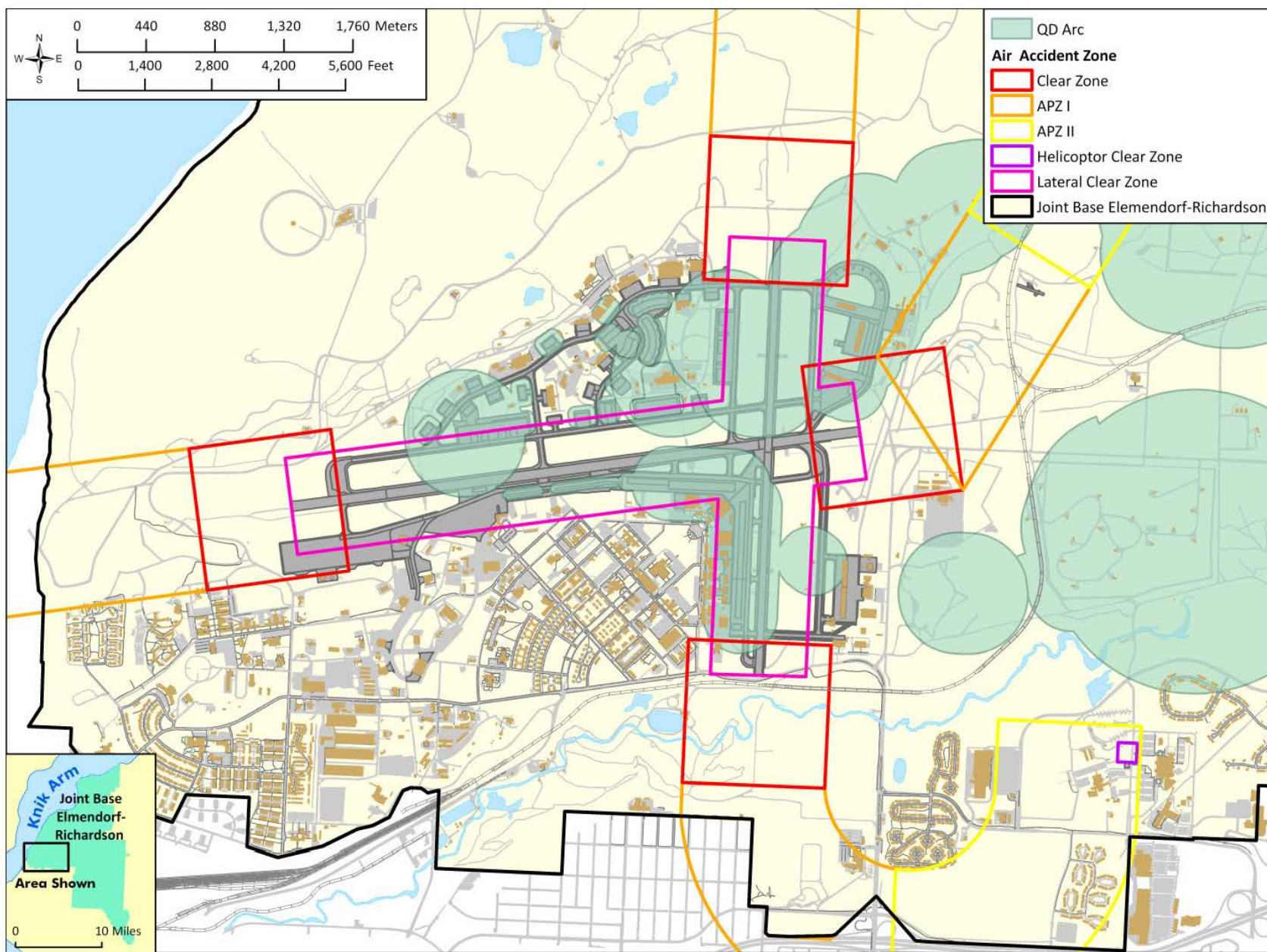
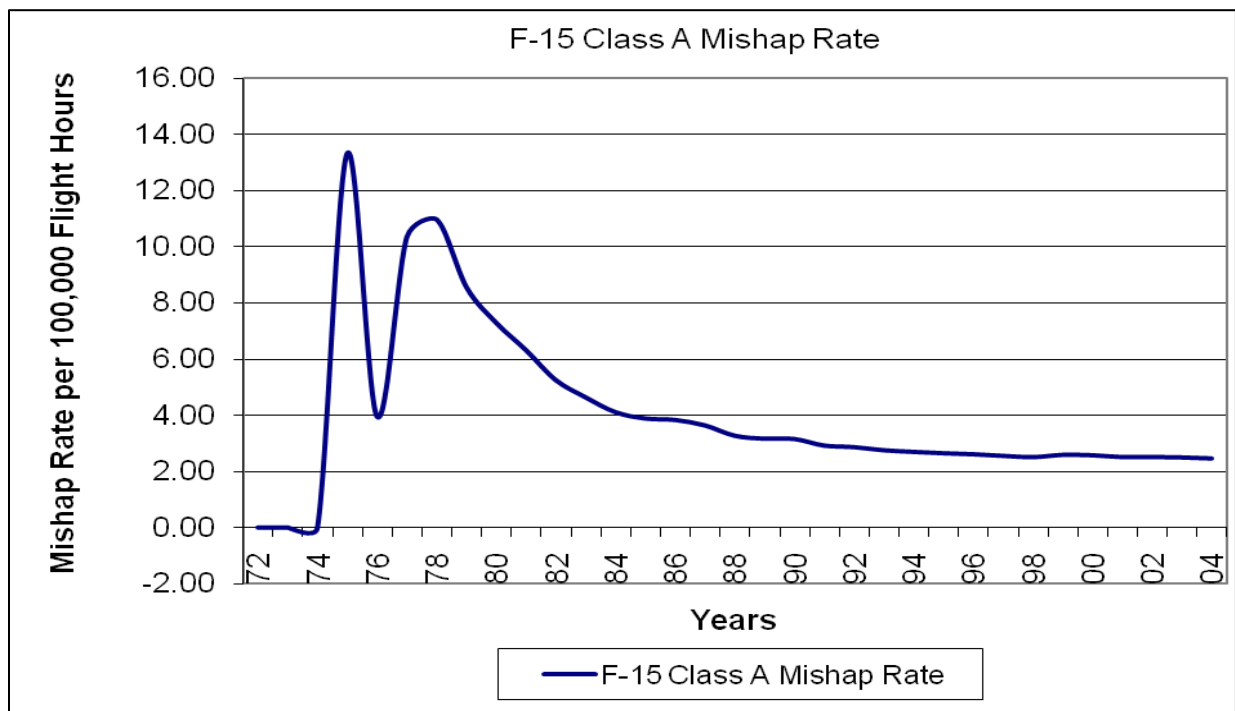


Figure 3.3-1. JBER-Elmendorf Clear Zones and Accident Potential Zones

Based on historical data on mishaps at all installations, and under all conditions of flight, the military services calculate Class A mishap rates per 100,000 flying hours for each type of aircraft in the inventory. These mishap rates do not consider combat losses due to enemy action. Mishap rates are only statistically predictive. The actual causes of mishaps are due to many factors, not simply the amount of flying time of the aircraft.

Considering all operations at JBER-Elmendorf in more than 25 years, there have been five Class A mishaps in the vicinity of the installation. Four were flight-related and one was non-flight-related. In 1995, an E-3 aircraft encountered a large flight of birds during takeoff. Birds were ingested into all engines resulting in a complete loss of power, and the aircraft crashed. In 2000, an aero club Cessna 152 departed controlled flight during a closed pattern, and crashed. In 1998, during engine shut down, a foreign object was ingested into the left engine of an F-15C while on the parking ramp. The aircraft did not crash although the dollar value of damages resulting from this incident required classification as a Class A mishap. In 2010 a C-17 preparing for an airshow crashed. Also in 2010 an F-22 crashed during a training mission in the Fox MOAs.

Mishap rates are statistically assessed as an occurrence rate per 100,000 flying hours. Figure 3.3-2 reflects the cumulative annual Class A mishap rates of a twin-engine air superiority fighter, the F-15, between 1972 and 2004. As the aircraft, the pilots who fly it, and the technicians who maintain it mature over time, mishap rates are reduced and maintain a relatively constant level. After eight years of flight, the F-22 approximate mishap rate is 6.35 for nearly 100,000 flight hours (Air Force Safety Center [AFSC] 2011b). This is almost exactly the same as the F-15 after eight years of flight, as depicted on Figure 3.3.2. The F-22 is a new aircraft and would be expected to have a long-term Class A mishap rate comparable to the F-15 mishap rate of 2.46 per 100,000 flight hours.



Source: Air Force Safety Center 2006.

Figure 3.3-2. F-15 Cumulative Class A Mishap Rates

3.0 Affected Environment**3.3.1.3 Wildlife Strike Hazard**

Bird-aircraft strikes or wildlife strikes on a runway constitute a safety concern because they can result in damage to aircraft, or injury to aircrews or local human populations if an aircraft crashes. Aircraft may encounter birds at altitudes up to 30,000 feet MSL or higher. However, most birds fly close to the ground. More than 97 percent of reported bird strikes occur below 3,000 feet AGL. Approximately 30 percent of bird strikes happen in the airport environment, and almost 55 percent occur during low-altitude flight training (AFSC 2011a).

Migratory waterfowl (e.g., ducks, geese, and swans) are the most hazardous birds to low-flying aircraft because of their size and their propensity for migrating in large flocks at a variety of elevations and times of day. Waterfowl vary considerably in size, from 1 to 2 pounds for ducks, 5 to 8 pounds for geese, and up to 20 pounds for most swans. There are two normal migratory seasons, fall and spring. Waterfowl are usually only a hazard during migratory seasons. These birds typically migrate at night and generally fly between 1,000 to 2,500 feet AGL during migration.

In addition to waterfowl, raptors, shorebirds, gulls, songbirds, and other birds also pose a hazard. In considering severity, the results of bird-aircraft strikes in restricted areas show that strikes involving raptors result in the majority of nationwide Class A and Class B mishaps related to bird-aircraft strikes. Raptors of greatest concern in the ROI are eagles and hawks. In Alaska, peak migration periods for waterfowl and raptors are from August to October and from April to May. A few bald eagles winter on JBER. In general, flights above 1,500 feet AGL would be above most migrating and wintering raptors.

Songbirds are small birds, usually less than one pound. During nocturnal migration periods, they navigate along major rivers, typically between 500 to 3,000 feet AGL. The potential for bird-aircraft strikes is greatest in areas used as migration corridors (flyways) or where birds congregate for foraging or resting (e.g., open water bodies, rivers, and wetlands).

While any bird-aircraft strike has the potential to be serious, many result in little or no damage to the aircraft, and only approximately 0.04 percent of all reported bird-aircraft strikes result in a Class A mishap (AFSC 2011a).

The 3 WG has developed aggressive procedures designed to minimize the occurrence of bird-aircraft strikes. The unit has documented detailed procedures to monitor and react to heightened risk of bird-strikes (Elmendorf AFB 2003), and when risk increases, limits are placed on low altitude flight and some types of training (e.g., multiple approaches, closed pattern work, etc.) in the airport environment. Special briefings are provided to pilots whenever the potential exists for greater bird-strike sightings within the airspace. Training and signs in open areas emphasize individual responsibilities and actions. Bird hazards exist at JBER-Elmendorf year-round. Risk increases during spring and fall migration periods. Species of particular concern include Canada geese, swans, other waterfowl, sandhill cranes, gulls, raptors, and owls (Elmendorf AFB 2003). 3 WG aircraft have experienced approximately five bird-strikes per year in the airfield environment (personal communication, Caristi 2011).

Other wildlife of concern to flying operations at JBER-Elmendorf includes moose, wolves, coyotes, fox, bears, and smaller mammals (Elmendorf AFB 2003). Aggressive habitat

management, fencing, active and passive dispersal techniques, and effective warning techniques serve to reduce the wildlife strike hazard at JBER-Elmendorf (Elmendorf AFB 2003). For example, security fencing around the airfield excludes most large mammals.

3.3.1.4 Explosives Safety

All activities associated with the receipt, processing, transportation, storage maintenance, and loading of munitions items is accomplished by qualified technicians in accordance with DoD and Air Force technical procedures. The 3 WG has sufficient storage facilities and space for the storage and processing of mission-required ordnance items (personal communication, Norby 2005).

There are three “hot cargo” pads on the installation, which are sufficient for handling explosive cargo. The primary pad is located near the eastern end of Runway 06/24. Additionally, there are two secondary pads. One is located toward the western end of Runway 06/24; the other is located off the extreme eastern end of Runway 06/24. All of the pads are situated north of the runway.

If required, support for explosive ordnance disposal (EOD) is provided by an active duty Air Force unit stationed at JBER. Sections 2.2.2 and 2.2.3 describe existing F-22 munitions and chaff and flare use as well as proposed use with an additional six F-22 aircraft. Adequate capacity exists at JBER to safely handle munitions currently used and the level of proposed use with the F-22 plus-up.

3.3.2 Training Airspace Existing Conditions

Flight training within the Alaskan airspace is conducted in a manner that protects other users of the area, as well as military pilots. JBER has existing programs and guidance to support safe operations and reduce risks associated with training in Alaskan airspace (Air Force 1995; Elmendorf AFB 2003; 3 WG 2004). This section addresses flight, ground, explosive, and other safety issues associated with 3 WG aircrew use of the regional military training airspace and its supporting assets and facilities.

3.3.2.1 Flight Safety

One JBER-Elmendorf F-22 Class A mishap in November 2010 resulted in the loss of the pilot and destruction of the aircraft. It is impossible to predict the precise location of an aircraft accident. Major considerations in any accident are loss of life and damage to property. The aircrew’s ability to exit from a malfunctioning aircraft is dependent on the type of malfunction encountered. The probability of an aircraft crashing into a populated area is extremely low, but it cannot be totally discounted. Several factors are relevant in the ROI: the training areas have low population densities, typically less than 0.1 person per square mile; F-22s train less than 0.5 percent of the time below 2,000 feet AGL; and the aircraft are over any specific geographic area for a very limited amount of time. There is very low probability that a disabled aircraft would impact a populated area.

Secondary effects of an aircraft crash include the potential for fire or environmental contamination. At a crash site, every effort is made to prevent access by unauthorized personnel.

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The extent of secondary effects is situation dependent, and announcements may be made to exclude unauthorized personnel until experts can determine the cause of the accident and collect all materials needed for the investigation and to ensure public safety.

The terrain overflowed in the ROI is diverse. For example, should a mishap occur in highly vegetated areas during a hot, dry summer, there would be a higher risk of fire than would a mishap in more barren and rocky areas during winter. An aircraft crash may release hydrocarbons. Those petroleum, oils, and lubricants not consumed in a fire could contaminate soil and water. The potential for contamination is dependent on several factors. For example, the porosity of the surface soils will determine how rapidly contaminants are absorbed, while the specific geologic structure in the region will determine the extent and direction of the contamination plume. The locations and characteristics of surface and groundwater in the area will also affect the extent of contamination to those resources.

Based on historical data on mishaps at all installations, and under all conditions of flight, the military services calculate Class A mishap rates per 100,000 flying hours for each type of aircraft in the inventory. These mishap rates do not consider combat losses due to enemy action.

In the case of MOAs, for each specific aircraft using the airspace, an estimated average sortie duration may be used to estimate annual flight hours in the airspace. Then, the Class A mishap rate per 100,000 flying hours can be used to compute a statistical projection of anticipated time between Class A mishaps in each applicable element of airspace. In evaluating this information, it should be emphasized that those data presented are only statistically predictive. The actual causes of mishaps are due to many factors, not simply the amount of flying time of the aircraft.

The F-22 is a new aircraft and has nearly accumulated the 100,000 flight hours to produce a valid Class A mishap rate. Proportioning the F-22 Class A mishaps and flight hours as of the end of FY 10 produces an approximate Class A mishap rate of 6.35 per 100,000 flight hours for eight years of testing and operations. F-15 aircraft, which have been flown since 1972, have accumulated more than 4,998,100 flight hours, and the F-15 has a Class A mishap rate of 2.46 per 100,000 flight hours (see Figure 3.3-2). Since mishap rates are statistically assessed as an occurrence rate per 100,000 flying hours, low use levels substantially influence the mishap rate. In its first eight years of flight testing and operations, the F-15 had an almost identical Class A mishap rate as the F-22 (see Figure 3.3-2). It is reasonable to expect that, as the F-22 weapon system matures, its rates will be as low as or lower than the historic F-15 rate.

The 3 WG maintains detailed emergency and mishap response plans to react to an aircraft accident. These plans assign agency responsibilities and prescribe functional activities necessary to react to major mishaps, whether on or off base. Response would normally occur in two phases. The initial response focuses on search and rescue, evacuation, fire suppression, safety, elimination of explosive devices, ensuring security of the area, and other actions immediately necessary to prevent loss of life or further property damage. Subsequently, the second, or investigation phase is accomplished. After all required actions on the site are complete, the aircraft will be removed and the site cleaned up. Depending on the extent of damage resulting from a Class A mishap, nearly all damaged parts are located and removed from a crash site.

First response to a crash scene is often provided by local emergency services nearest the scene. At the same time, the Air Force rapidly mobilizes a response team. The initial response element

consists of those personnel and agencies primarily responsible for the initial phase. This element will include the Fire Chief, who will normally be the first On-Scene Commander, fire-fighting and crash rescue personnel, medical personnel, security police, and crash recovery personnel. A subsequent response team will be comprised of an array of organizations whose participation will be governed by the circumstances associated with the mishap and actions required to be performed.

The Air Force has no specific rights or jurisdiction just because a military aircraft is involved. Regardless of the agency initially responding to the accident, efforts are directed at stabilizing the situation and minimizing further damage. If the accident has occurred on non-DoD property, and depending on the nature of the accident, the owning or management agency or individual responsible for the property would be notified, a National Defense Area would be established around the accident scene, and the site would be secured for the investigation phase.

Flight safety includes the potential for interaction between civil aviation and high performance military aircraft. Actions have been implemented by JBER to avoid Major Flying Exercises in MOAs during the September hunting season to reduce the potential for military aircraft being in a MOA while general aviation aircraft are ferrying hunters or fisherman. Past discussions with pilots, hunters, fishermen, and recreationists flying to use the land under the MOAs revealed that, although they occasionally sighted a military aircraft, they generally flew at lower altitudes than the military aircraft and both pilots practiced see-and-avoid measures (Air Force 2006). JBER pilots have been able to successfully train while being joint users of Alaskan airspace.

Flight safety also includes the potential for bird-aircraft strikes in the MOAs. In the case of the F-22, this risk is negligible because the F-22s normally fly at altitudes above the zone (0 to 3,000 feet AGL) where 95 percent of bird-aircraft strikes occur. Section 2.2 includes the flight altitude by percent of time for the F-22.

3.3.2.2 *Ground and Explosive Safety*

Aircrews from JBER train on air-to-ground ranges. Air-to-ground expenditure of munitions during training is limited to ranges within Restricted Airspace. Munitions use is presented in Table 2.2-4. Air Force safety standards require safeguards on weapons systems and ordnance to ensure against inadvertent releases. All munitions mounted on an aircraft, as well as the guns, are equipped with mechanisms that preclude release or firing without activation of an electronic arming circuit.

When live (high-explosive) ordnance impacts a target, it detonates, and the effects of this detonation are blast and overpressure in the immediate vicinity of the target. When a training (inert) air-to-ground weapon impacts on or near the target, it may skid, bounce, or burrow under the ground for some distance from the point of impact, coming to rest at some distance from that point. The military services have analyzed extensive historic data on ordnance and incorporated those data into a computer program (called SAFE-RANGE). SAFE-RANGE considers the type of ordnance, the aircraft, the delivery profile, the target type, as well as other data such as the demonstrated accuracy of the aircraft's bombing and navigation system. The program then calculates an area around the target within which either effects from live ordnance will spread, or the specific training or inert ordnance under consideration will come to rest. This area has dimensions in front of, behind, and on either side of the target. The results

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reflect (at a 95 percent confidence level) the geographic area which will contain 99.99 percent of the specific weapon's deliveries and their effects (Air Force 2001e).

Operations conducted by 3 WG aircrews have been subjected to these analyses. Detailed operating procedures published by the air-to-ground ranges that support 3 WG training ensure that all safety standards are met for the type of ordnance delivered, and the delivery profile associated with that ordnance delivery.

3.3.2.3 Chaff and Flare Use

Chaff and defensive flares are managed as ordnance. Chaff and flares are authorized for use by 3 WG crews. Use is governed by detailed operating procedures to ensure safety. Chaff and flare use are presented in Table 2.2-5.

F-22 RR-180/AL chaff, which is ejected from an aircraft to reflect radar signals, consists of fibers thinner than a human hair comprised of aluminum-coated silica packed into approximately 4-ounce bundles. When ejected, chaff forms a brief electronic "cloud" that temporarily masks the aircraft from radar detection. Although the chaff may be ejected from the aircraft using a small pyrotechnic charge, the chaff itself is not explosive (Air Force 1997). During FY 2009, 3 WG aircrews expended 17,132 bundles of chaff. Four 1-inch by 1/2-inch by 1/8-inch pieces of plastic and six 2-inch by 3-inch pieces of parchment paper fall to the ground along with the chaff fibers with each released chaff bundle. Appendix A provides an expanded discussion of chaff.

Defensive training flares consist of pellets of highly flammable material that burn rapidly at extremely high temperatures. Their purpose is to provide a heat source other than the aircraft's engine exhaust to mislead heat-sensitive or heat-seeking targeting systems and decoy them away from the aircraft. The flare, essentially a pellet of magnesium, ignites upon ejection from the aircraft and burns completely within approximately 3.5 to 5 seconds, or approximately 400 feet from its release point (Air Force 1997). The existing use of flares by F-22s as defensive countermeasures typically results in two 2-inch by 2-inch by 1/2 inch plastic pieces, one up to 4-inch by 15-inch piece of aluminum-coated mylar, and one 1-inch by 1/2-inch by 2-inch plastic S&I device falling to the ground. As discussed in Appendix B, Characteristics of Flares, and Appendix E, Review of Effects of Aircraft Noise, Chaff, and Flares on Biological Resources, flare residual materials are generally light with a high surface to weight ratio. This results in essentially no likelihood of a flare end cap, piston, or wrapper causing injury in the highly unlikely event such residual material from a flare struck a person or an animal. The only exception is the S&I device, which falls with the force of a medium-sized hailstone. Calculations of the likelihood of an S&I device striking an individual take into consideration the population density under the airspace, the number of flares deployed, and the amount of time the population was outside and unprotected, even by a hat.

If, for example, a population has an average density of 0.2 persons per square mile and is exposed 50 percent of the time under an airspace the size of the Stony MOA, and if 4,000 flares were deployed annually in the airspace, the expected strikes to a person would be one in 20,000 years. In other words, it is extremely unlikely that anyone would be struck with the force of a medium-sized hailstone as a result of Air Force training with flares in the airspace. A dud flare is an unburned flare which falls to the ground. Experiences at military training ranges which

have extensive flare use over decades demonstrate the dud flare rates to be an estimated 0.01 percent of flares deployed. A dud flare is extremely unlikely to be found on the ground. Finding a dud flare would be even less likely, and a person being seriously injured by a falling dud flare is so unlikely as to be nearly impossible (see Appendix B).

Concerns have also been expressed that a flare has the potential to start a fire if a flare were still burning when it hit the ground. As described in Chapter 2.0, flares burn out in approximately 400 feet. Air Force altitude restrictions for flare use in Alaskan MOA airspace (above 5,000 feet AGL June – September and above 2,000 feet AGL for the rest of the year) substantially reduce any risk of a fire from training with defensive flares.

3.4 Air Quality

This section discusses air quality considerations and conditions in the area around JBER near Anchorage, Alaska. It addresses air quality standards, describes current air quality conditions in the region, and presents the environmental consequences to JBER.

Air quality is determined by the type and concentration of pollutants in the atmosphere, the size and topography of the air basin, and local and regional meteorological influences. The significance of a pollutant concentration in a region or geographical area is determined by comparing it to federal and/or state ambient air quality standards. Under the authority of the CAA, USEPA has established nationwide air quality standards to protect public health and welfare, with an adequate margin of safety.

These federal standards, known as NAAQS, represent the maximum allowable atmospheric concentrations and were developed for six “criteria” pollutants: O₃, NO₂, CO, respirable particulate matter less than or equal to PM₁₀, SO₂, and Pb. The NAAQS are defined in terms of concentration (e.g., parts per million [ppm] or micrograms per cubic meter [µg/m³]) determined over various periods of time (averaging periods). Short-term standards (1-hour, 8-hour, or 24-hour periods) were established for pollutants with acute health effects and may not be exceeded more than once a year. Long-term standards (annual periods) were established for pollutants with chronic health effects and may never be exceeded.

Based on measured ambient criteria pollutant data, the USEPA designates areas of the U.S. as having air quality equal to or better than the NAAQS (attainment) or worse than the NAAQS (nonattainment). Upon achieving attainment, areas are considered to be in maintenance status for a period of ten or more years. Areas are designated as unclassifiable for a pollutant when there is insufficient ambient air quality data for the USEPA to form a basis of attainment status. For the purpose of applying air quality regulations, unclassifiable areas are treated similar to areas that are in attainment of the NAAQS.

Under the CAA, state and local agencies may establish ambient air quality standards and regulations of their own, provided that these are at least as stringent as the federal requirements. The State of Alaska air quality standards are presented in Table 3-4-1.

For non-attainment regions, the states are required to develop a SIP designed to eliminate or reduce the severity and number of NAAQS violations, with an underlying goal to bring state air quality conditions into (and maintain) compliance with the NAAQS by specific deadlines. The

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SIP is the primary means for the implementation, maintenance, and enforcement of the measures needed to attain and maintain the NAAQS in each state.

Table 3-4-1. Alaska Ambient Air Quality Standards (18 AAC 50.010)

<i>Parameter</i>	<i>1-hour</i>		<i>3-hour</i>		<i>8-hour</i>		<i>24-hour</i>		<i>Quarterly</i>	<i>Annual</i>	
	(mg/m ³)	(ppm)	(mg/m ³)	(ppm)	(mg/m ³)	(ppm)	(mg/m ³)	(ppm)	(mg/m ³)	(mg/m ³)	(ppm)
Ammonia (NH ₃)					2.1	3.0					
Carbon Monoxide (CO) ²	40	35			10	9.0					
Nitrogen Dioxide (NO ₂)										0.100	0.053
Ozone (O ₃)					4 th high 3-yr annual avg.						
					0.041	0.041					
Sulfur Dioxide (SO ₂)	196	0.02	1.300	0.497			0.365	0.139		0.080	0.031
							(mg/m ³) 3-year 98%		(mg/m ³)	(mg/m ³)	
Lead (Pb)									1.5*		
PM ₁₀							150				
PM ₂₅							35			15	

Notes:

1. PPM and 24 hour not applicable after August 23, 2011
2. National Standards

Source: Alaska State Air Quality Control Plan Amendments Volume II August 20, 2010 (ADEC 2010)

CAA Section 169A established the additional goal of prevention of further visibility impairment in Prevention of Significant Deterioration (PSD) Class I areas. Visibility impairment is defined as a reduction in the visual range, and atmospheric discoloration. Determination of the significance of an activity on visibility in a PSD Class I area can be associated with stationary or mobile source contributions.

Emission levels are used to qualitatively assess potential impairment to visibility in PSD Class I areas. Decreased visibility may potentially result from elevated concentrations of PM₁₀ and SO₂ in the lower atmosphere.

CAA Section 176(c), General Conformity, established certain statutory requirements for federal agencies with proposed federal activities to demonstrate conformity of the proposed activities with each state's SIP for attainment of the NAAQS.

General conformity applies only to nonattainment and maintenance areas. If the emissions from a federal action proposed in a nonattainment area exceed annual thresholds identified in the rule, a conformity determination is required of that action. The thresholds become more restrictive as the severity of the nonattainment status of the region increases.

In Alaska, the Alaska Department of Environmental Conservation has primary jurisdiction over air quality and stationary source emissions at JBER. Title V of the CAA Amendments of 1990 requires states to issue Federal Operating Permits for major stationary sources. A major stationary source in an attainment or maintenance area is a facility (i.e., plant, base, or activity) that emits more than 100 tons per year (TPY) of any one criteria air pollutant, 10 TPY of a hazardous air pollutant, or 25 TPY of any combination of hazardous air pollutants. Thresholds are lower for pollutants for which a region is in nonattainment status. The purpose of the

permitting rule is to establish regulatory control over large, industrial activities and to monitor their impact upon air quality.

3.4.1 *Base Existing Conditions*

Regional Air Quality. Federal regulations at 40 CFR 81 delineate certain air quality control regions (AQCRs), which were originally designated based on population and topographic criteria closely approximating each air basin. The potential influence of emissions on regional air quality would typically be confined to the air basin in which the emissions occur. JBER is located on the outskirts of Anchorage within the Cook Inlet Intrastate AQCR (AQCR 8), which encompasses 44,000 square miles including the Municipality of Anchorage, the Kenai Peninsula Borough, and the Matanuska-Susitna Borough (40 CFR 81).

Attainment Status. A review of federally published attainment status for Alaska indicated that Anchorage is in attainment of NAAQS for all criteria pollutants. The community of Eagle River, located north of JBER, was designated in attainment for PM₁₀ by USEPA in 2010. A portion of Anchorage was in nonattainment for CO in 2001 and has been in attainment since then. JBER is located adjacent to the northern boundary of this portion of Anchorage.

PSD Class I Areas. No mandatory federal PSD Class I areas are located within the ROI. The nearest PSD Class I area is Denali National Park, which is 100 miles north-northwest of JBER.

Climate. JBER is located in the maritime zone of south-central Alaska, with mean annual precipitation of approximately 16 inches, and snowfall averaging around 80 inches per year. Summertime highs average in the low to mid-60s and wintertime lows average in the low to mid-single digits Fahrenheit. Prevailing winds in Anchorage are generally light and from the north to northeast during September through April and from the south to southwest from May to August. Seasonal mixing heights for Anchorage, which is the upper limit of the atmosphere in which ground-based emissions are expected to affect air quality, average around 2,000 feet and may reach 1,000 feet during winter months.

Greenhouse Gases. Greenhouse gases (GHGs) are gases that trap heat in the atmosphere. These emissions are generated by both natural processes and human activities. The accumulation of GHGs in the atmosphere regulates the earth's temperature.

GHGs include water vapor, carbon dioxide, methane, nitrous oxide, ozone, and several hydrocarbons and chlorofluorocarbons. Each GHG has an estimated global warming potential (GWP), which is a function of its atmospheric lifetime and its ability to absorb and radiate infrared energy emitted from the Earth's surface. The GWP of a particular gas provides a relative basis for calculating its carbon dioxide equivalent (CO_{2e}) or the amount of carbon dioxide that emissions of that gas would be equal to. Carbon dioxide has a GWP of 1, and is, therefore, the standard by which all other GHGs are measured.

Table 3.4-2 presents the estimated GHG emissions and percentages of emissions as estimated for the State of Alaska for each Alaska Department of Environmental Conservation (ADEC) source category.

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Table 3.4-2. GHG Emissions & Percentages by ADEC Source Category

<i>ADEC Source Category</i>	<i>Total GHG Emissions (MMT CO_{2e})</i>	<i>% of Total GHG Emissions</i>
Electricity Production	2.18	11%
Military	0.97	5%
Mining	0.017	1%
Municipal	0.012	1%
Oil & Gas	15.26	73%
Other	1.76	8%
Seafood	0.16	1%
Totals	20.63	100%

Notes: MMT=Million metric tons

Source: Draft Summary Report of Improvements to the Alaska GHG Emission Inventory, ADEC, January 2008 (ADEC 2008).

Current Emissions. Air emissions at JBER result from stationary and mobile sources. Stationary sources include boilers, emergency generators, and aircraft maintenance operations. Mobile sources include ground-based vehicles and aircraft. JBER is considered to be a major source of air emissions. For permitting purposes, JBER-Elmendorf was divided into nine different facilities based on their industrial classifications, rather than on their collective ownership and control by the base. Only two of eight facilities, the hospital and the flightline, have potential criteria pollutant emissions large enough to require federal Title V operating permits. JBER also holds Owner Requested Limits, not included in the Title V permits, for Fire Protection Pumps and Road Painting. A 2010 summary of potential emissions is presented in Table 3.4-3.

Table 3.4-3. JBER Estimated Emissions Summary (2010)

<i>JBER Stationary Source Group</i>	<i>Criteria Pollutant PTE (tons/year)</i>				
	NO_x	CO	PM	VOCs	SO_x
45 – Transportation By Air (Flight Line)	249.426	137.711	18.669	15.426	6.692
48 – Communications	14.598	3.589	1.064	1.133	0.824
58 – Eating and Drinking Places	20.501	9.112	1.650	1.256	0.256
65 – Real Estate	60.862	32.388	4.916	3.557	0.388
70 – Hotels, Rooming Houses, Camps & Other Lodging	99.410	51.616	7.808	5.650	0.616
72 – Laundry and Garment Services	5.212	5.628	1.399	2.206	0.139
78 – Motion Pictures	2.830	1.138	0.234	0.169	0.018
79 – Amusement and Recreation Services	20.846	8.711	1.717	1.243	0.136
80 – Health Services	31.038	24.850	2.361	1.736	0.243
82 – Educational Services	10.975	5.443	0.891	0.645	0.070
83 – Social Services	10.812	5.090	0.882	0.638	0.070
86 – Membership Organizations	1.092	0.439	0.090	0.065	0.007
87 – Engineering, Accounting, Research, & Management	84.176	34.758	6.559	4.872	1.707
92 – Justice, Public Order, and Safety	9.338	4.920	0.731	0.578	0.157
97 – National Security	80.543	34.364	6.060	4.708	2.380
JBER Total Emissions	701.659	359.757	55.029	43.883	13.704
Elmendorf Draft Operating Permit 1-11-10 (PTE)	264.7	152.7	25.0	34.5	93.8
Fort Richardson Operating Permit 12-31-08 (PTE)	1183.2	1059.3	100.4	60	0.2
JBER PTE	1447.9	1212.0	125.4	94.5	94.0

Sources: 1. Fort Richardson Natural Gas Fired Emissions PTE Emissions Inventory
2. Alaska Department of Environmental Conservation Permit No. AQ0886TVP02
3. Alaska Department of Environmental Conservation Permit No. 237TVP01

The joint base does not have a combined emissions permit as of January 2011. The Air Force has a draft permit dated January 11, 2010. JBER-Richardson has disaggregated the 2008 stationary source permit into 14 stationary sources as allowed by USEPA. This provides for the privatization of electric, gas, and sanitary services on JBER-Richardson. As of December 22, 2010, JBER-Richardson has multiple Air Quality Control Minor Permits. The best available estimates of the Potential to Emit (PTE) on Table 3.4-3 are from the totals of JBER-Richardson's 2003 through 2008 and 2010 operating permits.

Regional Air Emissions. The previous section lists on-base emissions for JBER. The NEPA process also considers indirect emissions from stationary and mobile sources related to the project, some of which (for example, commuting of new employees to and from the facility) occur outside of the installation. For comparison purposes, Table 3.4-4 lists emissions for Greater Anchorage Area, and for Cook Inlet AQCR (AQCR 8, which includes the borough).

Table 3.4-4. Regional Emissions for Greater Anchorage Area

Region	Pollutants (In Tons per Year)				
	NO _x	CO	PM ₁₀	SO ₂	VOC
Greater Anchorage Area	10,740	123,883	19,856	920	5,764
Total Cook Inlet AQCR	28,203	332,021	67,013	1,780	56,708

Notes:

NO_x = nitrogen oxides; CO = carbon monoxide; PM₁₀ = particulate matter less than or equal to 10 micrometers in diameter; SO₂ = sulfur dioxide; VOC = volatile organic compound

Source: USEPA 2005.

The emissions from aircraft operations at JBER-Elmendorf including landings and takeoffs, touch-and-goes, and low approaches, would increase with the six additional F-22s. Table 3.4-5 presents the estimated operational emissions associated with the F-22 plus-up and compares the emissions to existing JBER emissions. The Holloman AFB estimated CO_{2e} emissions associated with 36 F-22 operational aircraft is calculated at 55,545 tons per year. This calculates to 9,257 tons per year of CO_{2e} for six operational aircraft.

Table 3.4-5. Annual Emissions Associated with Six Primary F-22s

Source	Emissions in Tons Per Year				
	NO _x	CO	PM ₁₀	VOC	SO _x
JBER PTE ¹	1447.9	1212.0	125.0	94.5	94.0
JBER Estimated Total Emissions ²	701.66	359.76	55.03	43.88	13.70
F-22 Operations (6 Primary Aircraft) ³	81.87	59.56	10.86	9.64	9.42

Sources 1. Table 3.4-3

2. Fort Richardson Natural Gas Fired Emissions PTE Emissions Inventory

3. Air Force emission estimates at Holloman AFB

3.4.2 Training Airspace Air Quality Existing Conditions

Section 162 of the CAA established the goal of Prevention of Significant Deterioration (PSD) of air quality in Class I areas. PSD Class I areas are areas where any appreciable deterioration of air quality is considered significant.

The likelihood for air quality impacts associated with an additional six F-22 training aircraft was evaluated based on the floor height of the primary MOAs relative to the mixing height for

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pollutants. For the area of the primary MOAs, the mixing height is 3,000 feet. As noted in Table 2.2-2, the existing F-22 altitude use below the average mixing height would be less than 0.5 percent of flight hours. Such low levels of training activity, distributed throughout the training airspace, would not contribute measurably to overall emissions.

3.5 Hazardous Materials and Waste Management**3.5.1 Base Existing Conditions**

Hazardous Materials. The majority of hazardous materials used by Air Force and contractor personnel at JBER-Elmendorf are controlled through an Air Force pollution prevention process called Hazardous Materials Pharmacy (HAZMART). This process provides centralized management of the procurement, handling, storage, and issuing of hazardous materials and turn-in, recovery, reuse, or recycling of hazardous materials. The HAZMART process includes review and approval by Air Force personnel to ensure users are aware of exposure and safety risks. Pollution prevention measures are likely to minimize chemical exposure to employees, reduce potential environmental impacts, and reduce costs for material purchasing and waste disposal.

Hazardous Waste Management. JBER is a large-quantity hazardous waste generator. Hazardous wastes generated during operations and maintenance activities include combustible solvents from parts washers, inorganic paint chips from lead abatement projects, fuel filters, metal-contaminated spent acids from aircraft corrosion control, painting wastes, battery acid, spent x-ray fixer, corrosive liquids from boiler operations, toxic sludge from wash racks, aviation fuel from tank cleanouts, and pesticides.

Hazardous wastes are managed in accordance with the JBER Plan 19-3. Hazardous wastes are initially stored at approximately 219 satellite accumulation areas. Satellite accumulation areas allow for the accumulation of up to 55 gallons of hazardous waste (or one quart of an acute hazardous waste) to be stored at or near the point of waste generation. There are two 90-day waste accumulation sites on JBER located at 4314 Kenney Avenue and 11735 Vandenberg Avenue. The base is identified by USEPA identification number AK8570028649. In FY 2009, 67,911 pounds of hazardous waste were removed from JBER and disposed of in off-base permitted disposal facilities.

The JBER Spill Prevention Control and Countermeasures Plan addresses on-base storage locations and proper handling procedures of all hazardous materials to minimize potential spills and releases. The plan further outlines activities to be undertaken to minimize the adverse effects of a spill, including notification, containment, decontamination, and cleanup of spilled materials.

Environmental Restoration Program (ERP). The DoD developed the ERP to identify, investigate, and remediate potentially hazardous material disposal sites on DoD property. In August 1990, Elmendorf AFB was placed on the National Priorities List bringing it under the federal facility provisions of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) Section 120. Currently JBER has identified 269 contaminated sites from operations. These sites have been placed into three groups: CERCLA sources (166 sites),

Compliance Restoration Program sites (67 sites) and Military Munitions Response Program Sites (36 sites) (personal communication, Caristi 2011).

3.5.2 Training Airspace Existing Conditions

Hazardous materials used by F-22s in the Alaskan airspace consist of various components and fluids of the aircraft itself. The plastic and other residual parts of chaff and flares after deployment are inert and non-hazardous. Under normal use, there would be no hazardous materials or waste management requirements associated with the F-22 plus-up under the airspace. See also Section 3.3.2 Airspace Safety.

3.6 Biological Resources

Biological resources in this discussion refer to plants and animals and the habitats in which they occur on and within the environs of JBER. Assemblages of plant and animal species within a defined area that are linked by ecological processes are referred to as natural communities. The existence and preservation of these resources are intrinsically valuable; they also provide aesthetic, recreational, and socioeconomic values to society. This section focuses on plant and animal species or vegetation types associated with JBER that typify or are important to the function of the ecosystem, are of special societal importance, or are protected under federal or state law or statute. For purposes of the analysis, JBER and neighboring biological resources will be organized into three major categories: (1) vegetation and habitat, including wetlands; (2) fish and wildlife; and (3) special-status species. In this section the ROI for biological resources is JBER-Elmendorf and its immediate vicinity.

Federal laws and regulations that apply to biological resources include: Fish and Wildlife Coordination Act, Migratory Bird Treaty Act (MBTA), CWA, NEPA, Federal Land Policy and Management Act, ESA, Sikes Act, Marine Mammal Protection Act (MMPA), state hunting regulations, and state laws protecting plants and nongame wildlife.

Vegetation includes all existing terrestrial plant communities and does not include special-status plants, which are discussed under special-status species below. The composition of plant species within a given area defines ecological communities and determines the types of wildlife that may be present. Wetlands are a special category of sensitive habitats and are subject to regulatory authority under Section 404 of the CWA, EO 11990 *Protection of Wetlands*, and EO 19988 *Floodplain Management*. The USACE administers the CWA, and has jurisdiction over all waters of the U.S., including wetlands. Jurisdictional wetlands are those areas that meet all the criteria defined in the USACE's *Wetlands Delineation Manual* (Environmental Laboratory 1987).

Fish and wildlife includes all vertebrate animals, with the exception of special-status species, which are discussed separately below. Typical animals include vertebrate groups such as fish, amphibians, songbirds, waterfowl, hoofed animals, carnivores, bats, rodents and other small mammals. The attributes and quality of available habitats determine the composition, diversity, and abundance patterns of wildlife species assemblages, or communities. Each species has its own set of habitat requirements and interspecific interactions driving its observed distribution and abundance. Community structure is derived from the net effect of the diverse resource and habitat requirements of each species within a geographic setting. For this reason, an assessment

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of habitat types and area affected by the Proposed Action can serve as an overriding determinant in the assessment of impacts for wildlife populations.

Special-status species are defined as those plant and animal species listed as threatened, endangered, candidate, or species of concern by the USFWS or the National Marine Fisheries Service, as well as those species with special-status designations by the State of Alaska. The ESA protects federally listed threatened and endangered plant and animal species. Candidate species are species that USFWS is considering for listing as threatened or endangered but for which a proposed rule has not yet been developed. Candidates do not benefit from legal protection under the ESA. In some instances, candidate species may be emergency listed if USFWS determines that the species population is at risk due to a potential or imminent impact. The USFWS encourages federal agencies to consider candidate species in their planning process because they may be listed in the future and, more importantly, because current actions may prevent future listing. Additionally, the USFWS maintains a list of Birds of Conservation Concern (USFWS 2008), which has a goal of accurately identifying the migratory and non-migratory bird species (beyond those already federally designated as threatened or endangered) that represent the USFWS' highest conservation priorities. The Alaska Department of Fish and Game also maintains a list of endangered species and species of special concern.

3.6.1 Base and Vicinity Existing Conditions

Vegetation. JBER is situated across rolling upland plains near the head of Cook Inlet (Knik Arm) in south central Alaska within the Coastal Trough Humid Taiga Province (Bailey 1995). The area is characterized by spruce-hardwood forests, bottomlands of spruce-poplar forests along major drainages, and dense stands of alder and willow along riparian corridors. Wet tundra communities bracket the coast.

The proposed F-22 plus-up of six primary aircraft would take place and operate from the portion of JBER formerly known as Elmendorf AFB. The biological discussion focuses on that portion of JBER referred to as JBER-Elmendorf. Approximately 4,038 acres of JBER-Elmendorf's 13,455 acres are classified as improved (buildings, runways, pavement, lawns) and 1,118 acres are classified as semi-improved (open fields around flightline, roads, munitions areas, and antenna fields) areas used for base facilities (Air Force 2007a). No plant species that are listed or have been proposed as candidates for federal listing as threatened or endangered are known to occur at JBER-Elmendorf (Air Force 2007a).

There are 1,534 acres of wetlands at JBER-Elmendorf (Air Force 2007a). Wetland types are varied and range from palustrine scrub-shrub and forested wetlands to lacustrine and estuarine wetlands.

Fish and Wildlife. JBER-Elmendorf supports a diverse array of wildlife species, including large and small mammals, raptors, waterfowl, songbirds, and fish. Due to the northerly latitude of the base, no reptiles occur, while the wood frog (*Rana sylvatica*) is the only amphibian species.

Moose (*Alces alces*), black bears (*Ursus americanus*), brown bears (*U. arctos*), and wolves (*Canis lupus*) are prevalent on the base and are typical residents of the Alaskan environment. These species have large home ranges that include JBER and Chugach State Park. Between 20 and 70

moose are estimated by Alaska Fish and Game to live on JBER-Elmendorf, depending on the time of year, as portions of the herd migrate off-base in fall and winter. Twelve to 24 black bears occur in summer, while 6 to 12 of these will spend the winter in dens on JBER-Elmendorf. Three to six brown bears inhabit JBER-Elmendorf in summer. Two wolf packs roam the lands of JBER (Air Force 2000). Coyotes (*Canis latrans*) are also common. Lynx (*Lynx canadensis*) and red fox (*Vulpes vulpes*) also occur.

Beluga whales are seasonally present in Cook Inlet adjacent to the air base, and frequently seen in the summer at the mouth of Six-Mile Creek. Harbor seals (*Phoca vitulina*), harbor porpoises (*Phocoena phocena*), and orca or killer whales (*Orcinus orca*) are uncommon in upper Cook Inlet, but are sighted occasionally. These species are all protected under the MMPA, and the CIBW is federally listed as an endangered species (73 FR 62919).

At least 112 bird species are known to occur or have the potential to occur at JBER-Elmendorf (Air Force 2000). Waterfowl and shorebirds use the base's ponds, bogs, wetlands, and coastal marshes in summer and on spring and fall migration. Raptors include osprey (*Pandion haliaetus*), red-tailed hawk (*Buteo jamaicensis*), rough-legged hawk (*B. lagopus*), sharp-shinned hawk (*Accipiter striatus*), northern goshawk (*A. gentils*), merlin (*Falco columbarius*), northern harrier (*Circus cyaneus*), northern saw-whet owl (*Aegolius acadicus*), boreal owl (*A. funereus*), and great horned owl (*Bubo virginianus*). Bald eagles (*Haliaeetus leucocephalus*), a formerly federally listed threatened species, also reside on the base. Common breeding birds include alder flycatcher (*Empidonax alnorum*), boreal chickadee (*Poecile hudsonica*), black-capped chickadee (*P. atricapillus*), gray jay (*Perisoreus Canadensis*), Swainson's thrush (*Catharus ustulatus*), myrtle warbler (*Dendroica coronata*), American robin (*Turdus migraterius*), slate-colored junco (*Junco hyemalis*), ruby-crowned kinglet (*Regulus calendula*), and white-winged crossbill (*Loxia leucoptera*).

Ten fish species occur at JBER-Elmendorf including five Pacific salmon species (Air Force 2000). Ship Creek, Six-Mile Creek, and Eagle River are the main spawning creeks for these anadromous fish on JBER.

Special-Status Species. There are no federally listed threatened or endangered species that inhabit JBER-Elmendorf (Table 3.6-1). The CIBW (*Delphinapterus leucas*), which is federally listed as endangered and an Alaska Species of Special Concern (AK SSC), inhabits the waters of Knik Arm adjacent to JBER-Elmendorf. This area is located to the east and north of JBER-Elmendorf runways and is overflown by existing F-22 aircraft on established approach, departure, and reentry patterns. The bald eagle, a former federally listed threatened species, is common locally with at least four pairs nesting on or adjacent to JBER-Elmendorf lands. This species received protection under both federal (Bald Eagle Protection Act) and state law (Air Force 2007a). AK SSC that may occur on or near the base include the olive-sided flycatcher (*Contopus borealis*), blackpoll warbler (*Dendroica striata*), peregrine falcon (*Falco peregrinus*), gray-cheeked thrush (*Catharus minimus*), Townsend's warbler (*Dendroica townsendi*), and the aforementioned CIBW (*Delphinapterus leucas*).

The olive-sided flycatcher and blackpoll warbler are known nesting species on the base (Air Force 2000). Both species are found in coniferous forests, with the flycatcher preferring more open forests (Ehrlich *et al.* 1988).

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Peregrine falcon and gray-cheeked thrush migrate through the area and may be occasionally observed (Air Force 2000). Peregrine falcons nest on cliffs, generally over water, but these features do not occur at JBER-Elmendorf. Peregrines may, however, use riparian and wetland areas on the base to hunt for prey, such as waterfowl. The gray-cheeked thrush breeds in moist coniferous forests and woodlands, arctic tundra, and riparian thickets. It is a habitat generalist on migration (Ehrlich et al. 1988), and therefore could occur in various habitats at JBER-Elmendorf. Townsend's warbler, another coniferous forest inhabitant, may also occur on base.

The rusty blackbird (*Euphagus carolinus*), a Bird Species of Conservation Concern (USFWS 2008), also breeds on JBER (personal communication, Koenen 2011) where it uses wet woodlands and swamps. A variety of shorebirds categorized as Bird Species of Conservation Concern (USFWS 2008) migrate through JBER. These include lesser yellowlegs, solitary sandpiper, whimbrel, bristle-thighed curlew, and Hudsonian godwit (personal communication, Koenen 2011).

3.6.2 Training Airspace Existing Conditions

Biological resources under the existing F-22 training airspace include vegetation and habitat, wetlands, fish and wildlife, and special-status species. Section 3.6.1 describes these resources and lists the species occurring on JBER. The ROI for training airspace in Alaska includes all lands under the MOAs, ATCAAs, Restricted Areas, and Warning Areas currently used by the F-22s at JBER-Elmendorf.

Existing training airspace used by F-22s at JBER-Elmendorf occurs primarily in MOAs and ATCAAs. Depending on the MOA and overlying ATCAA, training may currently be authorized from 500 feet AGL to above 60,000 feet MSL. The F-22 rarely (2 percent or less) flies below 5,000 feet AGL. In some MOAs, supersonic flight is authorized and occurs about 25 percent of the F-22 training time. The F-22 operates between 10,000 and 30,000 feet MSL 25 percent of the time and greater than 30,000 feet MSL 70 percent of the time (see Table 2.2-2). W-612 is infrequently used for F-22 training. MTRs are not used for F-22 training.

Vegetation. The existing training airspace overlies the Upland Tundra and Boreal Forest ecoregions (Bailey 1995). Predominant land cover types are forests (60 percent), fields (17 percent), and tundra (15 percent) (Air Force 2001a). Forest types are largely evergreen and mixed conifer/deciduous. Over 8.1 million acres of special use areas occur under these MOAs. This includes National Wildlife Refuges under the Galena and Yukon 2, 4, and 5 MOAs and Denali National Park and Preserve under portions of the Susitna MOA, which are discussed in Section 3.8, Land Use.

In Alaska, wetlands cover over 43 percent of the state's land, in contrast with the lower 48 states, where they occupy 5.2 percent. About 1,952,000 acres of aquatic habitats and wetlands occur under the existing training airspace (Air Force 2001a). Wetland types under the airspace are largely deciduous, evergreen, and mixed forest wetlands.

Table 3.6-1. The Occurrence of Special-Status Species at JBER-Elmendorf and Environs

<i>Common Name</i>	<i>Scientific Name</i>	<i>Status</i>	<i>Occurrence at JBER</i>
Aleutian shield fern	<i>Polystichum aleuticum</i>	FE	No
Chinook salmon (Fall stock from Snake River)	<i>Oncorhynchus tshawytscha</i>	FT, AK SSC	No
Steelhead (Snake River Basin)	<i>Onchorhynchus mykiss</i>	FT	No
Leatherback sea turtle	<i>Dermochelys coriacea</i>	FE	No
Green sea turtle	<i>Chelonia mydas</i>	FT	No
Loggerhead sea turtle	<i>Caretta caretta</i>	FT	No
Short-tailed albatross	<i>Phoebastria albatrus</i>	FE, AKE	No
Kittlitz's murrelet	<i>Brachyramphus brevirostris</i>	FC	No
Eskimo curlew	<i>Numenius borealis</i>	FE, AKE	No
Spectacled eider	<i>Somateria fischeri</i>	FT, AK SSC	No
Stellar's eider (AK breeding population)	<i>Polysticta stelleri</i>	FT, AK SSC	No
Aleutian Canada goose	<i>Branta canadensis leucopareia</i>	AK SSC	No
Arctic peregrine falcon	<i>Falco peregrinus</i>	AK SSC	Potential Migrant
Northern goshawk (southeast AK population)	<i>Accipiter gentilis laingi</i>	AK SSC	No
Olive-sided flycatcher	<i>Contopus cooperi</i>	AK SSC	Yes
Gray-cheeked thrush	<i>Catharus minimus</i>	AK SSC	Migrant
Townsend's warbler	<i>Dendroica townsendi</i>	AK SSC	Potential
Blackpoll warbler	<i>Dendroica striata</i>	AK SSC	Yes
Yellow-billed Loon	<i>Gavia adamsii</i>	Candidate	No
Kittlitz's murrelet	<i>Brachyramphus brevirostris</i>	Candidate	Yes
Brown bear (Kenai Peninsula population)	<i>Ursus arctos horribilis</i>	AK SSC	No
Sea otter (southwest Alaska distinct population segment)	<i>Enhydra lutris kenyoni</i>	FT, AK SSC	No
Harbor seal	<i>Phoca vitulina</i>	AK SSC	No
Steller sea-lion	<i>Eumetopias jubatus</i>	FT=eastern population, FE=western population AK SSC	No
Bowhead whale	<i>Balaena mysticetus</i>	FE, AKE	No
Finback whale	<i>Balaenoptera physalus</i>	FE	No
Humpback whale	<i>Megaptera novaeangliae</i>	FE, AKE	No
Right whale	<i>Eubalaena glacialis</i>	FE, AKE	No
Blue whale	<i>Balaenoptera musculus</i>	FE, AKE	No
Sei whale	<i>Balaenoptera borealis</i>	FE	No
Sperm whale	<i>Physeter macrocephalus</i>	FE	No
Cook Inlet Beluga Whale (CIBW) (population)	<i>Delphinapterus leucas</i>	FE, AK SSC	No, but occur in adjacent waters of the Knik Arm, which would be overflowed by F-22s.

Notes:

FE = Federal Endangered; FT = Federal Threatened; FC = Federal Candidate; AKE = State of Alaska Endangered; AK SSC = State of Alaska Species of Special Concern.

Sources: Alaska Department of Fish and Game 2011a and 2011b, USFWS 2005.

3.0 Affected Environment

Fish and Wildlife. Common fish and wildlife species under the existing airspace are generally as described in Section 3.6.1. Regionally important game species include moose, caribou (*Rangifer tarandus*), Dall's sheep (*Ovis dalli*), bears, and various species of waterfowl. Moose, caribou, and Dall's sheep have critical lambing/calving, wintering, and rutting areas underneath the training airspace. The Air Force has existing airspace restrictions that prevent potential overflight effects on these and other wildlife species (Air Force 1995).

Special-Status Species. Special-status species include species designated as threatened, endangered, or candidate species by state or federal agencies. No federally listed species occur on lands under the existing training airspace. Five Alaska species of special concern likely occur under the training airspace. These are peregrine falcon, olive-sided flycatcher, gray-cheeked thrush, blackpoll warbler, and Townsend's warbler. Habitat requirements of these species are discussed in Section 3.6.1.

3.7 Cultural Resources

Cultural resources are any prehistoric or historic district, site, or building, structure, or object considered important to a culture or community for scientific, traditional, religious, or other purposes. They include archaeological resources, historic architectural resources, and traditional resources. Archaeological resources are locations where prehistoric or historic activity measurably altered the earth or produced deposits of physical remains (e.g., arrowheads, bottles). Historic architectural resources include standing buildings and other structures of historic or aesthetic significance. Architectural resources generally must be more than 50 years old to be considered for inclusion in the NRHP, although resources dating to defined periods of historical significance, such as the Cold War era (1945-1989) may also be considered eligible. Traditional resources are associated with cultural practices and beliefs of a living community that are rooted in its history and are important in maintaining the continuing cultural identity of the community. Historic properties (as defined in 36 CFR 60.4) are significant archaeological, architectural, or traditional resources that are either eligible for listing, or listed on, the NRHP. Both historic properties and significant traditional resources identified by Alaska Natives are evaluated for potential adverse impacts from an action.

For the Proposed Action, the ROI for cultural resources is defined as JBER-Elmendorf and its environs.

3.7.1 Base Existing Conditions

3.7.1.1 Archaeological Resources

Since the beginning of cultural resource investigations at JBER-Elmendorf in 1978, most survey work has been concentrated along the northwest border of the base property. Through these survey efforts 27 archaeological sites have been located at JBER. Twenty sites are recommended as ineligible for the NRHP, five are unevaluated, and two are considered eligible (Air Force 2008; Elmendorf AFB 2010). No NRHP-listed archaeological resources have been located in the project area (Air Force 2008; National Register Information Service [NRIS] 2011).

3.7.1.2 Architectural Resources

There are 54 NRHP eligible buildings or structures on JBER-Elmendorf, most of which are located in one of three historic districts: the Flightline Historic District adjacent to the runway; the Alaska Air Depot Historic District west of the main cantonment area; and the Generals' Quad Historic District (Figure 3.7-1). Other historic structures at JBER outside the three historic districts include 12 Cold War-era facilities (Air Force 2010a).

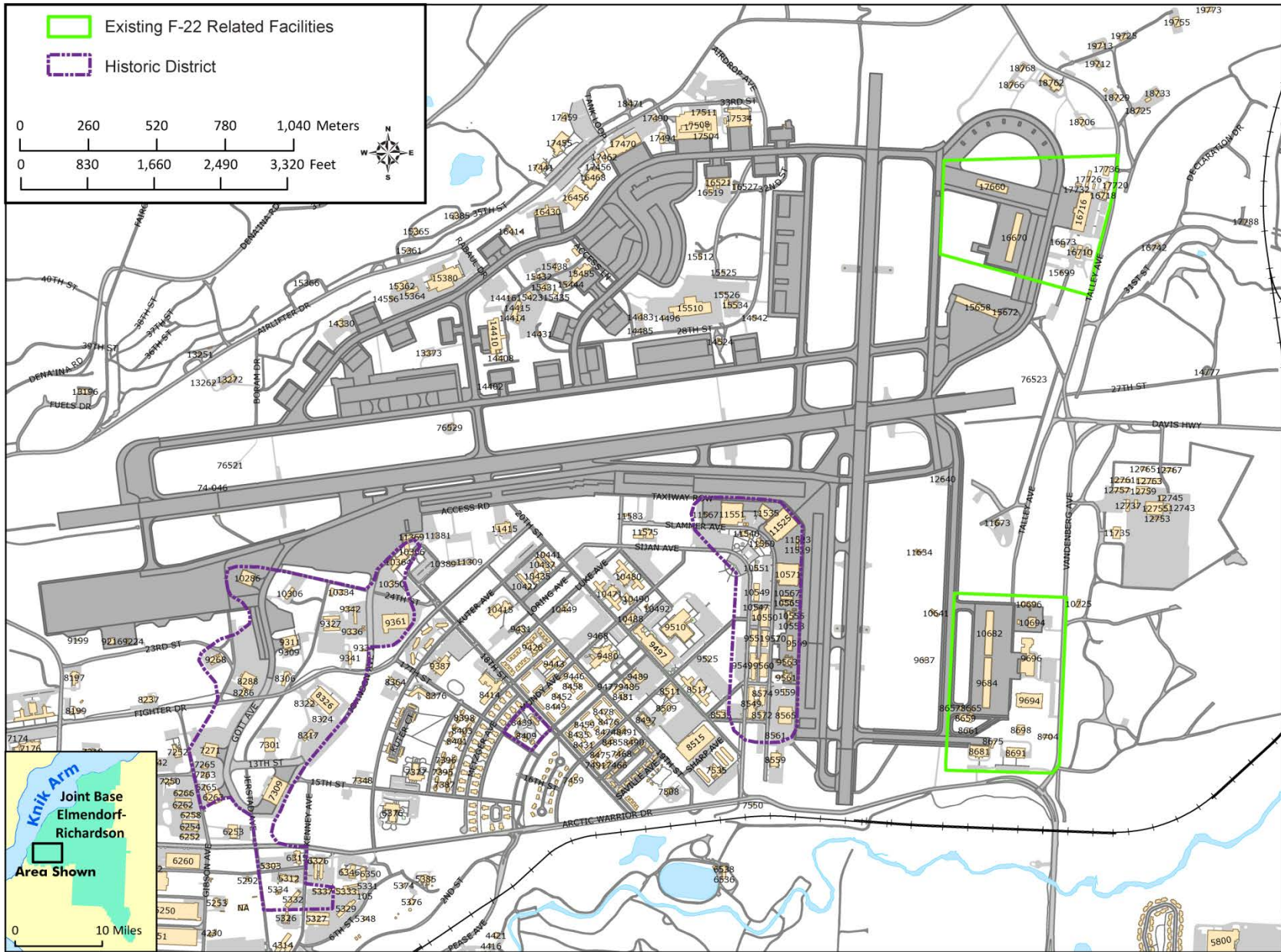


Figure 3.7-1. Historic Districts within the JBER-Elmendorf Project Area

3.0 Affected Environment**3.7.1.3 *Traditional Cultural Properties and Alaska Native Concerns***

Although no traditional cultural properties have yet been identified on JBER-Elmendorf, neighboring Alaska Natives have raised concerns regarding the possibility of Alaska Native burials located on JBER-Elmendorf property (Air Force 2008b). Ongoing consultation between the Air Force and Alaska Natives on this and other issues is conducted on a government-to-government basis. The federally recognized tribes in the nearby area are the Eklutna and Knik Tribes (Air Force 2008a).

3.7.2 *Training Airspace Existing Conditions*

Archaeological sites under training airspace include native burial grounds, village and settlement sites, and historic mining sites (Air Force 2006). Architectural resources under the proposed MOAs include structures relating to gold mining, trapping, or the railroad (Air Force 2006). In addition to NRHP-listed sites, there are likely to be additional cultural resources that are either eligible or potentially eligible for NRHP listing under airspace. Federally recognized Alaska Native villages under or near the airspace discussed below are illustrated in Figure 3.7-2.

3.7.2.1 *Galena MOA*

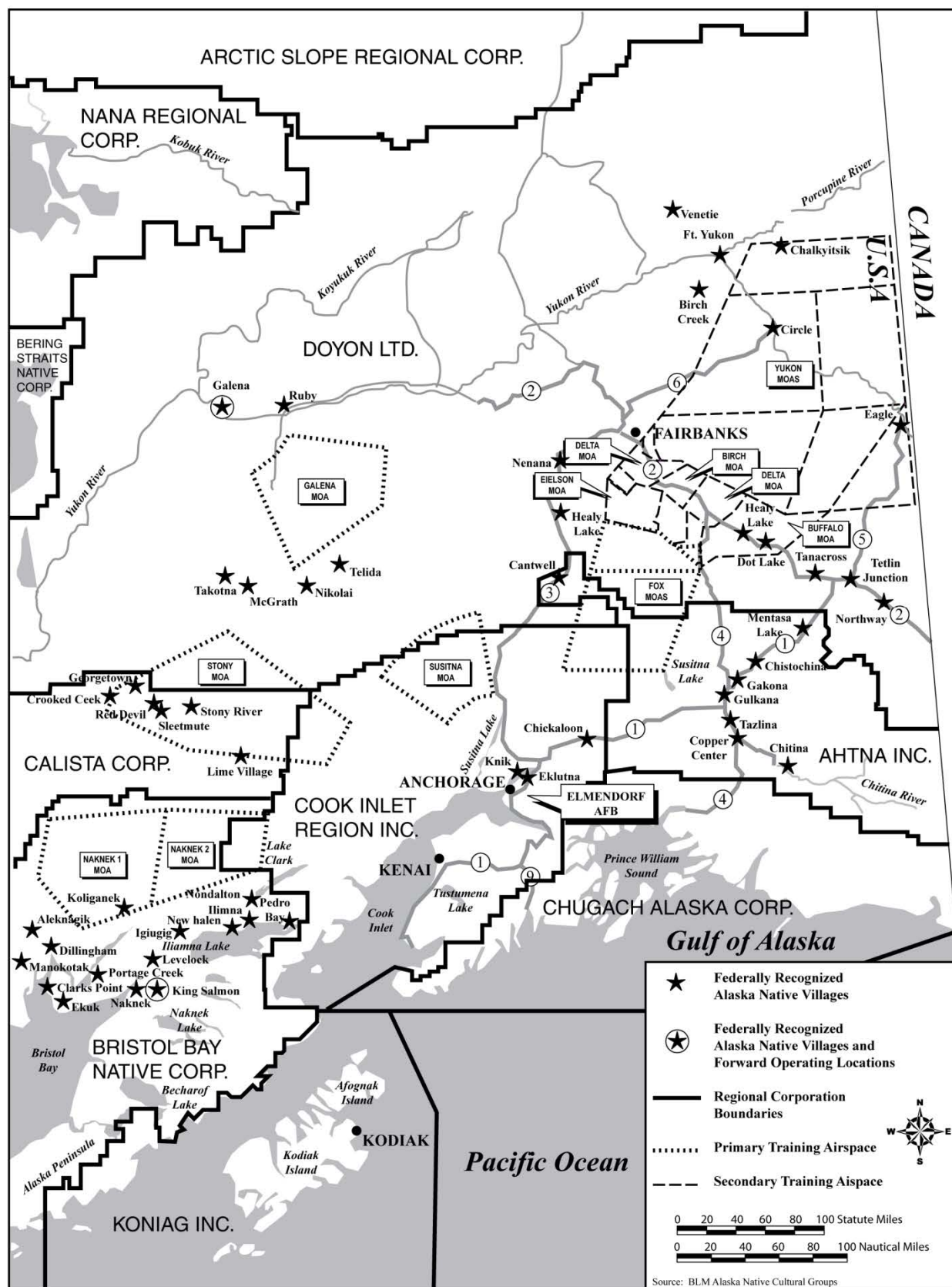
There are no NRHP-listed cultural sites under the Galena MOA (National Register Information Service [NRIS] 2011). However, connecting trails of the Iditarod National Historic Trail are located under the MOA. The Iditarod Trail is a network of more than 2,300 trails which takes its name from an Athabascan Indian village. Trails used by the Ingalik and Tanaina Indians and Russian fur traders were improved by miners in the early 1900s. The trails were heavily used by miners until 1924 when airplanes came into use (Bureau of Land Management [BLM] 2000). In 1925, dog teams and drivers gained national attention when they delivered diphtheria serum from Nenana to Nome in 127 hours along the trail. The annual Iditarod race retraces the route.

3.7.2.2 *Stony A/B MOA*

The Stony A and B MOAs lie above the Kolicachuk, Upper Kuskokwim and Deg Hit'An language regions (Alaska Native Knowledge Network 2000). There is one NRHP-listed resource under the Stony A,B MOAs. The Kolmakov Redoubt Site is in the Sleetmute area under Stony B (NRIS 2011).

Federally recognized Alaska Native villages under or near the airspace are: Crooked Creek, Georgetown, Lime Village, Red Devil, Sleetmute, and Stony River (Bureau of Indian Affairs 2000).

Crooked Creek was reported by a Russian explorer in 1844 as “Kvikchapak” in Yup'ik and “Khottylna” in Ingalik (Alaska Department of Community and Economic Development [DCED] 2000). At that time the site was used as a summer fish camp for the Kwigiapainukamuit villagers. A permanent settlement was established there in 1909 as a way-station for the Flat and Iditarod gold camps. A trading post was founded in the upper village (upriver from the creek mouth) in 1914, and a post office and school were built in the late 1920s. The lower village was settled by Eskimo and Ingalik people. Native lifestyle is based on subsistence activities including salmon, moose, caribou, and waterfowl (Alaska DCED 2000). Both parts of the village remain today.



3.0 Affected Environment

Georgetown is on the north bank of the upper Kuskokwim River in the Kilbuck-Kuskokwim Mountains. Europeans first entered the middle Kuskokwim area in 1844 when the Russian explorer Zagoskin sailed upriver to McGrath. At that time, Georgetown was a summer fish camp for residents of Kwigiapainukamuit and was known as Keledzhichagat (Alaska DCED 2000). Gold was found along the George River in 1909 and the mining settlement of Georgetown was named for three traders.

The town grew to about 200 cabins and several stores. By 1953, only one large structure from the mining era remained: a two-story cabin that belonged to George Fredericks. The present settlement developed in the 1950s. A state school was established in 1965 and remained until 1970. Georgetown is presently used as a seasonal fishing camp. It has no year-round residents (Alaska DCED 2000).

Lime Village is on the south bank of the Stony River south of McGrath. It is a Dena'ina Athabascan Indian settlement that was settled by Europeans in 1907. Residents of nearby Lake Clark used the location as a summer fishing camp (Alaska DCED 2000). The 1939 U.S. Census called the settlement Hungry Village. Sts. Constantine and Helen, a Russian Orthodox chapel was built there in 1960 and a state school constructed in 1974 (Alaska DCED 2000). Presently, subsistence is based on hunting and gathering with some seasonal work in fire fighting and trapping.

Red Devil is located on both banks of the Kuskokwim River at the mouth of Red Devil Creek. The village was named after the Red Devil mercury mine established in 1921. The mine continued to operate until 1971 (Alaska DCED 2000). The village is a mix of Eskimo, Athabascan, and non-native inhabitants who supplement their income with subsistence activities.

Sleetmute is on the east bank of the Kuskokwim River. It is an Ingalik Indian village that has also been known as Sikkiut, Steelmut, and Steitmute (Alaska DCED 2000). A Russian trading post was built at the nearby Holitna River junction 1.5 miles away, but was moved farther downriver in 1841. Another trading post was started at Sleetmute in 1906. A school and post office opened in the 1920s and a Russian Orthodox church was built in 1931 (Alaska DCED 2000).

Stony River, also known as Moose Village and Moose Creek, is on the north bank of the Kuskokwim River near its junction with the Stony River. It began as a trading post and riverboat landing supplying mining operations to the north (Alaska DCED 2000). The first trading post and post office were opened during the 1930s, and area natives established residency there in the 1960s. The village is a mix of Athabascan and Eskimo people who depend heavily on a subsistence economy.

3.7.2.3 Susitna MOA

No NRHP-listed cultural resources are under this MOA (NRIS 2011). No federally recognized Alaska Native villages are located under Susitna airspace (Bureau of Indian Affairs 2000).

3.7.2.4 Naknek 1/2 MOAs

There are no NRHP-listed resources under the Naknek MOAs (NRIS 2011). One federally recognized Alaska Native village, Koliganek, lies under the edge of Naknek 1 airspace (Bureau of Indian Affairs 2000).

Koliganek is on the Nushagak River north of Dillingham. First contact with Europeans occurred in the early 19th century when Russian fur traders entered the area. Prior to its present location, the village was on Tikchik Lake near the headwaters of the Nuyakuk River (Bristol Bay Native Association 2000). Archaeological excavations indicate the site was occupied from about 1820 until the turn of the 19th century by people who practiced a coastal Bering Sea Eskimo lifeway, hunting sea mammals, fishing, and trapping on land (Bristol Bay Native Association 2000). After a flu epidemic, residents moved to the confluence of the Nuyakuk and Nushagak Rivers (Old Koliganek). A Russian Orthodox church, St. Yako, was established in the village in 1870. The residents moved to another site in 1938 (Middle Koliganek) because of a decreasing supply of firewood near the village. The present site was established in 1964. Residents depend on the Bristol Bay commercial salmon fishery and fur trapping. The Koliganek Traditional Council is the governing body for the Native residents of Koliganek (Bristol Bay Native Association 2000).

3.7.2.5 Fox MOAs

Although there are no Alaska Native Villages within this area, there are scattered remote residences and BLM-managed recreation areas. The area is frequently used for subsistence and recreational hunting (BLM 2006). Additionally, the NRHP-listed Tangle Lakes Archaeological district is located on lands underlying the Fox MOA. The district contains more than 400 recorded archaeological sites spanning 10,000 years of human presence in the region (BLM 2006).

3.7.2.6 Birch, Buffalo, Eielson, and Viper MOAs

No federally recognized Alaska Native villages are located under these MOAs. Rapids Roadhouse, also known as Black Rapids Roadhouse, in Delta, underlies Buffalo MOA and is the only NRHP-listed cultural resource under these MOAs (NRIS 2011).

3.7.2.7 Delta MOA

There are three NRHP-listed properties under the Delta MOA, all of which are architectural resources. They are the Big Delta Historic District (also known as Big Delta State Historical Park), Delta Junction; Rika's Landing Roadhouse (also known as Rika's Landing Site), Big Delta; and Sullivan Roadhouse, Delta Junction (NRIS 2011).

3.7.2.8 Yukon MOAs

The Yukon MOAs overlie a large area to the north and east of Fairbanks. Several native villages occur in this area, as well as 11 NRHP-listed resources (NRIS 2011).

3.0 Affected Environment

The small village of Healy Lake, 29 miles east of Delta Junction, is under the Yukon 1 MOA. Healy Lake is home to the federally recognized Healy Lake Village Council. Predominant activity in the area is the recreational use of Healy Lake during summer months.

The village of Circle underlies Yukon 2 MOA, on the south bank of the Yukon River at the edge of the Yukon Flats National Wildlife Refuge, about 160 miles northeast of Fairbanks. The federally recognized Circle Native Community is predominantly Athabaskan. Circle, or Circle City, was established in 1893 as a supply point for goods shipped up the Yukon River and then to the gold mining camps. By 1896, Circle was the largest mining town on the Yukon, with a population of 700. Residents, some of whom are part-time, now number approximately 100. The Coal Creek Historic Mining District is among the 11 properties listed on the NRHP.

The federally recognized Alaska Native Village of Eagle underlies Yukon 3 MOA, six miles west of the Alaska Canadian border. It is located on the Taylor Highway, on the left bank of the Yukon River at the mouth of Mission Creek. The area has been the historical home to Han Kutchin Indians, and was once known by non-Native Alaskans as “Johnny’s,” after a leader named John. The adjacent community of Eagle saw its beginnings around 1874 as a log house trading station. Named “Belle Isle,” the station continued to provide supplies and trade goods for prospectors who worked the upper Yukon and its tributaries until Eagle City was founded at the site in 1897. Fort Egbert was established adjacent to Eagle in 1899; a major accomplishment was construction of part of the Washington-Alaska Military Cable and Telegraph System in 1903. Eagle was incorporated in 1901, becoming the first incorporated city in the Interior. Several NRHP properties occur in or near Eagle, including the Eagle Historic District, Woodchopper Roadhouse, the Frank Slaven Roadhouse, the Steele Creek Roadhouse, the George McGregor Cabin and the Ed Beiderman Fish Camp (NRIS 2010). Eagle is listed in the NRIS as the location of the Chicken Historic District, but it is 66 miles south of Eagle on the Taylor Highway.

The Alaska Native Village Chalkyitsik underlies Yukon 5 MOA. Archaeological excavations indicate this region may have been first used as early as 12,000 years ago. This village on the Black River has traditionally been an important seasonal fishing site for the Gwich’in. Village elders remember a highly nomadic way of life where from autumn into the spring they lived at the headwaters of the Black River, and fished downriver in the summer. Contact with early explorers was limited, and the Black River Gwich’in receive scant mention in early records. The location of the village at its present site is due in part to low water in the Black River in the 1930s. A boat carrying materials intended for a school to be built in Salmon Village had to be unloaded at the Chalkyitsik seasonal fishing camp that then consisted of four cabins. Rather than reload the construction materials, the school was built at Chalkyitsik, and the Black River people began to settle around the school.

3.8 Land Use, Transportation, and Recreation

The attributes of JBER-Elmendorf and nearby land use addressed in this analysis include general land use patterns, land ownership, land management plans, and applicable plans and ordinances. General land use patterns characterize the types of uses within a particular area including human land uses, such as agricultural, residential, commercial, industrial, institutional, and recreational, or natural land uses, such as forests, refuges, and other open

spaces. Land ownership is a categorization of land according to type of owner; the major land ownership categories associated with JBER-Elmendorf include federal and state with nearby private and Alaska Native properties. Land use plans and ordinances, policies, and guidelines establish appropriate goals for future use, or regulate allowed uses.

The major land ownership categories under the SUA include state, federal, Alaska Native corporations, and other private landowners. Federal lands are described by the managing agency, which may include the USFWS, the U.S. Forest Service, BLM, or DoD. State of Alaska land under the study area is typically managed by the Departments of Fish and Game or Natural Resources. The land management plans include those documents prepared by agencies to establish appropriate goals for future use and development. As part of this process, sensitive land use areas are often identified by agencies as being worthy of more rigorous management. As noted in Section 3.1, FAA administers all navigable national airspace.

Recreation resources consider outdoor recreational activities that take place away from the residences of participants. This includes natural resources and man-made facilities that are designated or available for public recreational use in remote areas. As part of the mitigations identified for the MOA Environmental Impact Statement (EIS) Record of Decision (ROD), the Air Force participates in the Resource Protection Council to work with agencies, Alaska Natives, and others in the identification and mitigation of potential consequences to environmental resources (Air Force 1995).

Transportation resources include the infrastructure required for the movement of people, materials, and goods. For this analysis, transportation resources include JBER-Elmendorf roads and the railway.

The ROI for land use and recreation consists of JBER-Elmendorf and all the lands under the existing training airspace used for JBER-Elmendorf F-22 training.

3.8.1 *Base Existing Conditions*

JBER is located at the head of Cook Inlet within the Municipality of Anchorage. JBER-Elmendorf comprises 13,455 acres of JBER's total 84,000 acres of federal land directly north of the Municipality of Anchorage in the south-central portion of the State of Alaska.

3.8.1.1 *JBER-Elmendorf Land Use*

Figure 3.8-1 depicts existing land uses for JBER-Elmendorf. The airfield and related operation function are located in the center and southern part of the base. A variety of other land uses may be found along the southern portion of the base. A large industrial area forms a boundary between the central mixed-use core of the base and the housing and services area in the base's southwest corner. Medical facilities are located in the southeast corner, along with some housing and recreational areas. Large recreational and open space areas are also located north of the airfield (Air Force 2005). Restricted Use Areas have been designated to prohibit construction of manned facilities in areas that were previously contaminated.



The southwest corner of the base has housing developments, community services and offices.

3.0 Affected Environment

JBER-Elmendorf is bordered to the east by the Fort Richardson portion of JBER. There are various training ranges within the military installations, including maneuver areas, impact areas, and training areas. To the west of JBER-Elmendorf are the Port of Anchorage and Cook Inlet/Knik Arm. The city of Anchorage borders the base to the south. Privately held lands in the vicinity of the base are located primarily south and southeast of the base (Air Force 2001a). This includes a residential neighborhood known as Mountain View. Mountain View Elementary School is located on the north side of McPhee Avenue that runs along the southern boundary of JBER.

The base adopted a General Plan in April 2005 that presents a comprehensive planning strategy to support military missions assigned to the installation and guide future installation development decisions. With a 50 year horizon, the plan presents a summary of existing conditions and provides a framework for programming, design and construction, as well as resource management. The plan's Fighter Town East (FTE) Focus Area is on the east side of the north-south runway (Runway 16/34). This area enabled development of all the necessary facilities and infrastructure associated with the beddown of the F-22 fighter aircraft begun in 2006.

Base plans and studies present factors affecting both on- and off-base land use and include recommendations to assist on-base officials and local community leaders in ensuring compatible development in the vicinity of the base. In general, land use recommendations are made for areas affected by both the potential for aircraft accidents (refer to Section 3.3, Safety) and aircraft noise (refer to Section 3.2, Noise). There are safety zones defined for each end of the runway based on the analysis of historic mishap data that defines where most aircraft accidents occur. Incompatible residential uses in the community of Mountain View exist within the safety zones at the end of Runway 16/34 (see Figure 3.3-1).

Noise contours in these plans are generated by the modeling program NOISEMAP. These noise contours are used to describe noise exposure around the base and support compatible land use recommendations. Noise is one of the major factors used in determining appropriate land uses since elevated sound levels are incompatible with certain land uses. When noise levels exceed an L_{dn} of 65 dB, residential land uses are normally considered incompatible (see Appendix D). Noise exposure (depicted with contours) from existing operations at JBER-Elmendorf are shown in Figure 3.2-1. These contours provide the baseline against which to measure the projected change should the additional six primary and one backup F-22 be based at JBER-Elmendorf.

3.8.1.2 JBER-Elmendorf Transportation

JBER-Elmendorf is accessed by Davis Highway from JBER-Richardson and Glenn Highway from the south. Vandenberg Avenue extends northward from the main gate (Boniface Gate) about 1.5 miles before intersecting Davis Highway which extends eastward to JBER-Richardson.



The JBER Transportation system includes an extensive road network as well as winter opportunities for recreation.

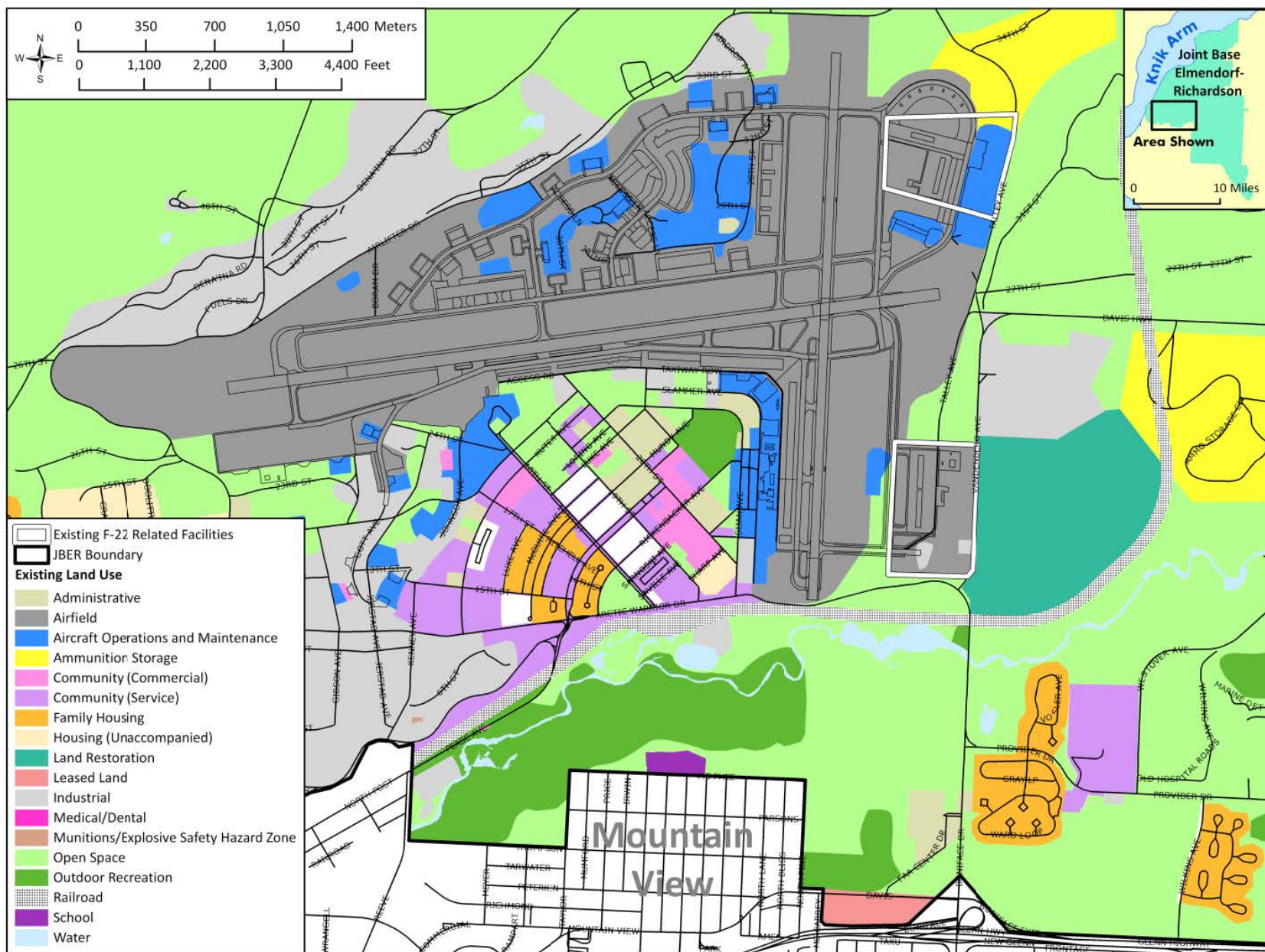


Figure 3.8-1. JBER-Elmendorf Existing Land Use

3.0 Affected Environment

Roads on JBER-Elmendorf form a network independent from vicinity roads (refer to Figure 3.8-2). Access on and off the base occur through four gates on the south side (Boniface, Muldoon, Post Road, and Government Hill), as well as access from JBER-Richardson. Vehicular traffic is permitted on most base streets; restricted access may occur for operational or security reasons.

Primary roadways on JBER-Elmendorf include Davis Highway and Post Road. The former serves the eastern portion of the base and provides primary access to JBER-Richardson. Provider Drive, which connects to the Glenn Highway, also provides important access to the southeast corner of the base including the hospital. Secondary roadways include Airlifter Drive, Fighter Drive, and Arctic Warrior Drive.

The latter provides access from the west side of the base to the FTE area, which supports the existing two squadrons of F-22 aircraft. The FTE area is also accessed by Vandenberg Avenue and the Davis Highway.

The rail line is located in the south and east portions of JBER-Elmendorf (refer to Figure 3.8-2). The tracks have been relocated to the east to avoid security and safety hazards. The tracks are within the right of way and belong to the Alaska Railroad Company. All other tracks on the base are owned by the Air Force (Air Force 2004).

3.8.2 Training Airspace Existing Conditions

The general land use patterns underlying this airspace may be characterized as very rural. There are large public land areas as well as some agricultural forested areas. There are also a number of small towns and villages throughout the area that occur along roads and highways, as well as in remote areas accessible only by waterways or small planes. Within populated areas, a variety of land use types occur, including residential, commercial, industrial, and public lands.

Special use areas provide recreational activities (trails and parks), hunting, fishing, and/or solitude or wilderness experience (parks, forests, and wilderness areas). Table 3.8-1 identifies special use areas under the airspace units. Figures 3.8-3 and 3.8-4 present these special use areas under or near training airspace. This broad grouping of special use areas includes large public land areas such as state or national parks, forests, and reserves which may include individual campgrounds, trails, and visitor centers. This broad definition of special use areas also includes large private land areas under the airspace.

3.8.2.1 Galena and Susitna MOAs

Special use areas of note underlying the Alaskan airspace include designated wildlife areas, trails, and parks. The Nowitna National Wildlife Refuge under the Galena MOA is managed by the USFWS. This refuge encompasses forested lowlands, hills, lakes, marshes, ponds, and streams and the nationally designated Nowitna River. The refuge was established to protect waterfowl and their habitat. Hunting, fishing, and river floating are recreational activities within the refuge.

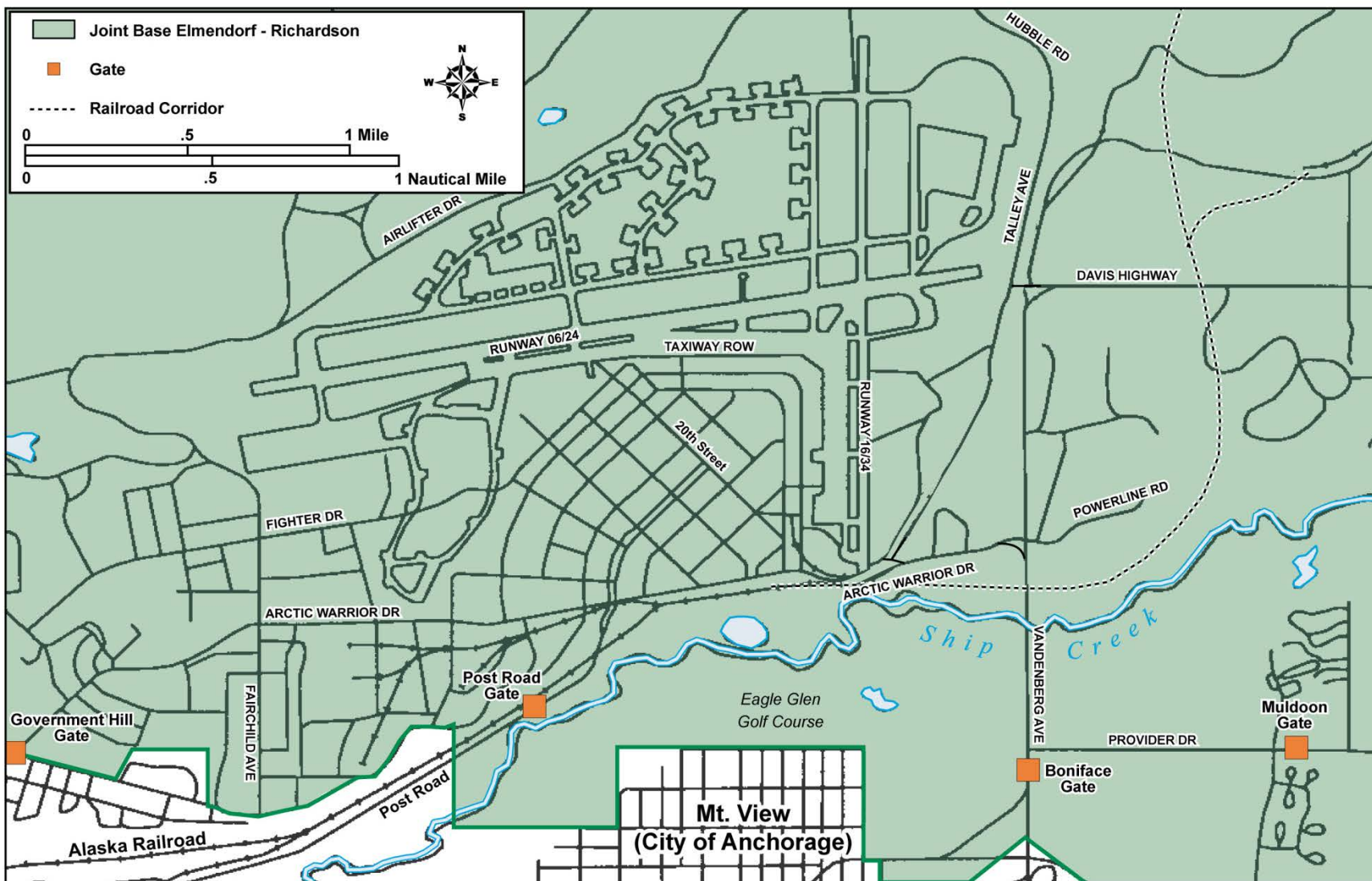


Figure 3.8-2. JBER-Elmendorf Roads

3.0 Affected Environment

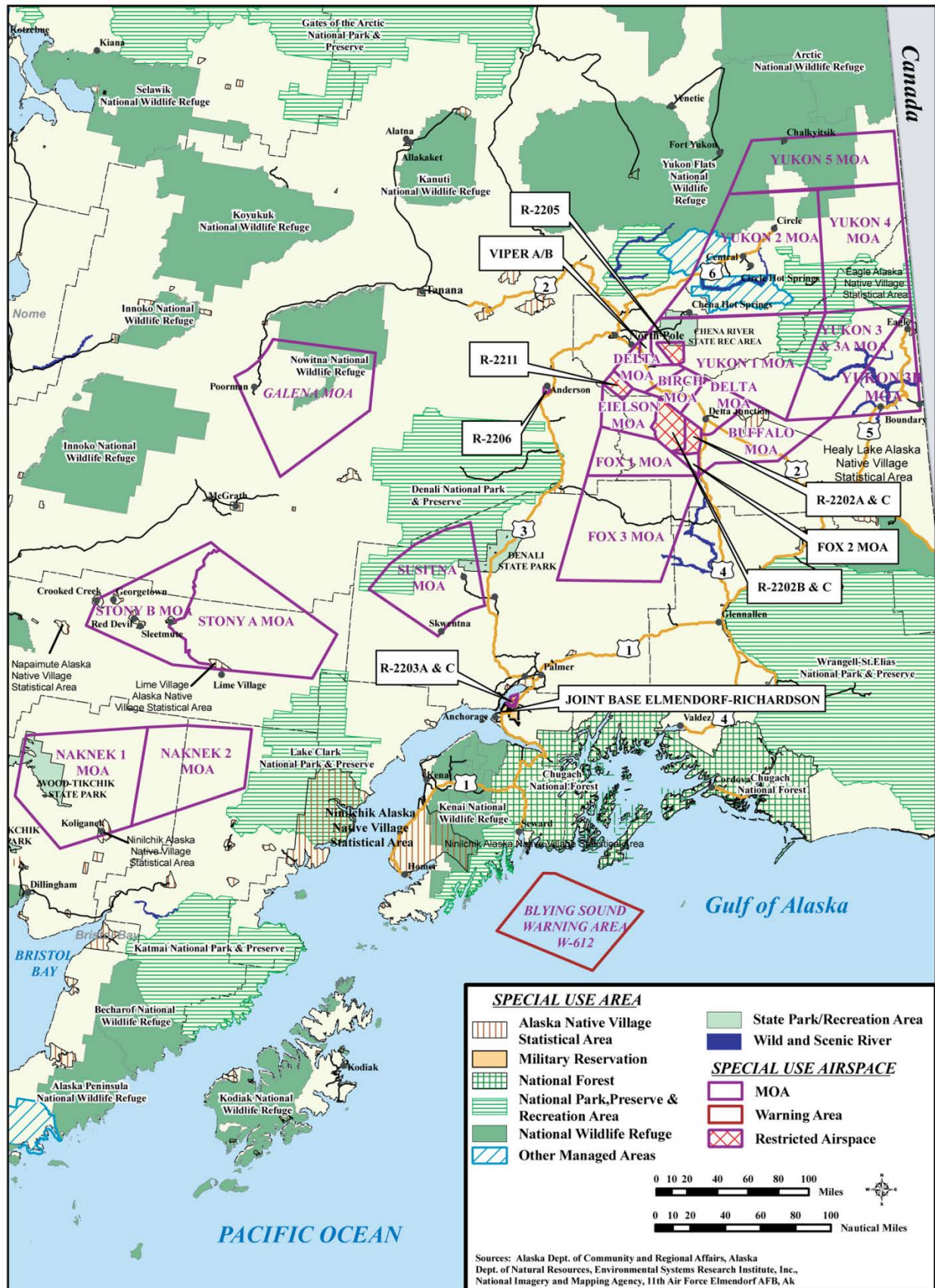


Figure 3.8-3. Special Use Areas Underlying Special Use Airspace

Table 3.8-1. Special Use Areas within F-22 Airspace (Page 1 of 3)

<i>Airspace</i>	<i>Special Use Area</i>	<i>Designation</i>	<i>Total Area of Airspace (acres)</i>	<i>Total Area of Special Use Area (acres)</i>	<i>Special Use Area Within Airspace (acres)</i>	<i>% of Special Use Area Within Airspace</i>	<i>% of Airspace Which is Special Use Area</i>
Birch MOA	Birch Lake State Recreation Site	State Recreation Area	359,488	204	204	100.00	0.06
Birch MOA	Doyon	Alaska Native Regional Corp.	359,488	127,831,010	359,488	0.28	100.00
Buffalo MOA	Doyon	Alaska Native Regional Corp.	1,398,549	127,831,010	1,289,746	1.01	92.22
Buffalo MOA	Healy Lake	Alaska Native Village Statistical Area	1,398,549	109,933	108,803	98.97	7.78
Delta MOA ¹	Doyon	Alaska Native Regional Corp.	956,008	127,831,010	692,156	0.54	72.40
Eielson MOA	Doyon	Alaska Native Regional Corp.	611,159	127,831,010	611,159	0.48	100.00
Fox 1 MOA	Doyon	Alaska Native Regional Corp.	968,360	127,831,010	968,360	0.76	100.00
Fox 2 MOA	Doyon	Alaska Native Regional Corp.	79,544	127,831,010	79,544	0.06	100.00
Fox 3 MOA	Ahtna	Alaska Native Regional Corp.	3,142,055	18,407,946	861,045	4.68	27.40
Fox 3 MOA	Cook Inlet	Alaska Native Regional Corp.	3,142,055	21,308,085	896,648	4.21	28.54
Fox 3 MOA	Doyon	Alaska Native Regional Corp.	3,142,055	127,831,010	1,384,361	1.08	44.06
Fox 3 MOA	Gulkana Wild & Scenic River	Wild and Scenic River	3,142,055	105,257	5,414	5.14	0.17
Galena MOA	Doyon	Alaska Native Regional Corp.	3,314,834	127,831,010	3,314,836	2.59	100.00
Galena MOA	Nowitna National Wildlife Refuge	National Wildlife Refuge	3,314,834	2,019,411	612,935	30.35	18.49
Naknek 1 MOA	Bristol Bay	Alaska Native Regional Corp.	3,294,225	26,195,347	3,251,606	12.41	98.71
Naknek 1 MOA	Koliganek	Alaska Native Village Statistical Area	3,294,225	62,162	44,179	71.07	1.34
Naknek 1 MOA	Wood-Tilchik State Park	State Park	3,294,225	515,427	395,979	76.83	12.02
Naknek 2 MOA	Bristol Bay	Alaska Native Regional Corp.	2,339,458	26,195,347	1,832,356	6.99	78.32
Naknek 2 MOA	Cook Inlet	Alaska Native Regional Corp.	2,339,458	21,308,085	505,018	2.37	21.59
Stony A MOA	Calista	Alaska Native Regional Corp.	3,430,001	33,099,981	1,939,436	5.86	56.54
Stony A MOA	Cook Inlet	Alaska Native Regional Corp.	3,430,001	21,308,085	552,642	2.59	16.11
Stony A MOA	Doyon	Alaska Native Regional Corp.	3,430,001	127,831,010	908,096	0.71	26.48
Stony A MOA	Lime Village	Alaska Native Village Statistical Area	3,430,001	34,186	33,007	96.55	0.96

Table 3.8-1. Special Use Areas within F-22 Airspace (Page 2 of 3)

<i>Airspace</i>	<i>Special Use Area</i>	<i>Designation</i>	<i>Total Area of Airspace (acres)</i>	<i>Total Area of Special Use Area (acres)</i>	<i>Special Use Area Within Airspace (acres)</i>	<i>% of Special Use Area Within Airspace</i>	<i>% of Airspace Which is Special Use Area</i>
Stony A MOA	Stony River	Alaska Native Village Statistical Area	3,430,001	13,018	3,019	23.19	0.09
Stony B MOA	Calista	Alaska Native Regional Corp.	2,016,837	33,099,981	1,441,097	4.35	71.45
Stony B MOA	Crooked Creek	Alaska Native Village Statistical Area	2,016,837	27,906	15,159	54.32	0.75
Stony B MOA	Doyon	Alaska Native Regional Corp.	2,016,837	127,831,010	499,096	0.39	24.75
Stony B MOA	Georgetown	Alaska Native Village Statistical Area	2,016,837	16,659	16,659	100.00	0.83
Stony B MOA	Red Devil	Alaska Native Village Statistical Area	2,016,837	16,275	16,275	100.00	0.81
Stony B MOA	Sleetmute	Alaska Native Village Statistical Area	2,016,837	18,945	18,945	100.00	0.94
Stony B MOA	Stony River	Alaska Native Village Statistical Area	2,016,837	13,018	9,999	76.81	0.50
Susitna MOA	Cook Inlet	Alaska Native Regional Corp.	2,098,465	21,308,085	1,716,651	8.06	81.81
Susitna MOA	Denali National Park & Preserve	National Park National Preserve	2,098,465	6,029,385	553,989 391,748	9.19 6.5	26.4 18.67
Susitna MOA	Denali State Park	State Park	2,098,465	324,242	50,985	15.72	2.43
Susitna MOA	Doyon	Alaska Native Regional Corp.	2,098,465	127,831,010	381,175	0.30	18.16
Yukon 1 MOA	Chena River State Rec Area	State Recreation Area	3,198,318	303,481.281	256,708.482	84.59	8.03
Yukon 1 MOA	Doyon	Alaska Native Regional Corp.	3,198,318	127,831,010	3,198,318	2.50	100.00
Yukon 1 MOA	Fortymile Wild & Scenic River	Wild and Scenic River	3,198,318	226,745	673	0.30	0.02
Yukon 1 MOA	Healy Lake	Alaska Native Village Statistical Area	3,198,318	109,933	1	0.00	0.00
Yukon 1 MOA	Yukon-Charley Rivers National Preserve	National Preserve	3,198,318	2,521,315	499,384	19.81	15.61
Yukon 2 MOA	Birch Creek Wild & Scenic River	Wild and Scenic River	4,180,238	68,867	68,867	100.00	1.65

Table 3.8-1. Special Use Areas within F-22 Airspace (Page 3 of 3)

<i>Airspace</i>	<i>Special Use Area</i>	<i>Designation</i>	<i>Total Area of Airspace (acres)</i>	<i>Total Area of Special Use Area (acres)</i>	<i>Special Use Area Within Airspace (acres)</i>	<i>% of Special Use Area Within Airspace</i>	<i>% of Airspace Which is Special Use Area</i>
Yukon 2 MOA Restricted Area 2205	Chena River State Rec Area	State Recreation Area	4,180,238	303481.281	46087.982	15.19	1.10
Yukon 2 MOA	Circle	Alaska Native Village Statistical Area	4,180,238	3,643	3,643	100.00	0.09
Yukon 2 MOA	Doyon	Alaska Native Regional Corp.	4,180,238	127,831,010	4,176,595	3.27	99.91
Yukon 2 MOA	Steese National Conservation Area	National Conservation Area	4,180,238	1,154,018	785,042	68.03	18.78
Yukon 2 MOA	Yukon Flats National Wildlife Refuge	National Wildlife Refuge	4,180,238	11,172,807	654,752	5.86	15.66
Yukon 2 MOA	Yukon-Charley Rivers National Preserve	National Preserve	4,180,238	2,521,315	592,117	23.48	14.16
Yukon 3 MOA	Doyon	Alaska Native Regional Corp.	3,207,858	127,831,010	3,194,193	2.50	99.57
Yukon 3 MOA	Eagle	Alaska Native Village Statistical Area	3,207,858	23,353	13,665	58.52	0.43
Yukon 3 MOA	Fortymile Wild & Scenic River	Wild and Scenic River	3,207,858	247,049	223,607	90.51	6.97
Yukon 3 MOA	Yukon-Charley Rivers National Preserve	National Preserve	3,207,858	2,521,315	375,752	14.90	11.71
Yukon 4 MOA	Doyon	Alaska Native Regional Corp.	2,846,455	127,831,010	2,846,455	2.23	100.00
Yukon 4 MOA	Yukon Flats National Wildlife Refuge	National Wildlife Refuge	2,846,455	11,172,807	149,644	1.34	5.26
Yukon 4 MOA	Yukon-Charley Rivers National Preserve	National Preserve	2,846,455	2,521,315	998,833	39.62	35.09
Yukon 5 MOA	Chalkyitsik	Alaska Native Village Statistical Area	2,285,414	1,546	1,546	100.00	0.07
Yukon 5 MOA	Doyon	Alaska Native Regional Corp.	2,285,414	127,831,010	2,283,868	1.79	99.93
Yukon 5 MOA	Yukon Flats National Wildlife Refuge	National Wildlife Refuge	2,285,414	11,172,807	1,469,990	13.16	64.32
Viper MOA	Doyon	Alaska Native Regional Corp.	68,181	127,831,010	68,181	0.05	100.00

Notes: 1 - Includes only the portions of Delta MOA west of Birch MOA and between the Birch and Buffalo MOAs MOA = Military Operations Area

Source: National Geospatial-Intelligence Agency 2005

3.0 Affected Environment

Segments of the Iditarod National Historic Trail underlie the Galena and Susitna MOAs (Air Force 1995). The Iditarod Trail is a network of more than 2,300 trails that takes its name from an Athabascan Indian village.

A portion of Denali State Park, about 550,000 acres of Denali National Park, and about 400,000 acres of Denali National Preserve also underlie the northern portion of the Susitna MOA. Denali National Park, managed by the National Park Service, was established in 1917 as Mount McKinley National Park. In 1980, the Alaska National Interest Lands Conservation Act expanded the boundary by four million acres and renamed it Denali National Park and Preserve. Denali is currently six million acres in size. There are three distinct units that make up Denali National Park and Preserve: Denali Wilderness, Denali National Preserve, and Denali National Park. The Susitna MOA does not overlie the Denali Wilderness.

3.8.2.2 Fox and Stony MOAs

Lands underlying the Fox MOA include the Tangle Lakes, Tangle River, Delta River, Gulkana River, components of the National Wild and Scenic River System, Tangle Lakes Archaeological District, and Nelchina Public Use Area. Although there are no communities within this area, there are scattered remote residences. The Fox MOA overlies areas frequently used for recreational hunting, including BLM-managed recreation areas.

Stony A and B MOAs overlie a number of small communities including Georgetown, Crooked Creek, Red Devil, Sleetmute, and Stony River.

3.8.2.3 Yukon and Viper MOAs

The Yukon MOAs overlie remote residences or parcels along the Salcha River, as well as the communities of Circle, Central, Circle Hot Springs, Chena Hot Springs, Eagle, Chicken, Eagle Village, Boundary, and Chalkyitsik. Some of the special use areas within this area include the Yukon-Charley Rivers National Preserve, Charley National Wild River, and Fortymile National Wild, Scenic, and Recreational River. Notices along these rivers, such as the Birch Creek Wild and Scenic River, explain the SUA and the use of the airspace to recreationists.

3.8.2.3 Restricted Areas

With the exception of the Chena River State Recreation Area, no special land use areas occur under Restricted Areas. A small portion of the southern boundary of the Chena River State Recreation Area underlies R-2205 (see Figure 3.8-4).

3.9 Socioeconomics

Socioeconomic factors are defined as the basic attributes and resources associated with the human environment. Data for the socioeconomic analysis in this EA were obtained from a variety of sources, including the Air Force, the U.S. Bureau of the Census, the U.S. Bureau of Economic Analysis, the Alaska Departments of Commerce and Labor, and the Municipality of Anchorage.

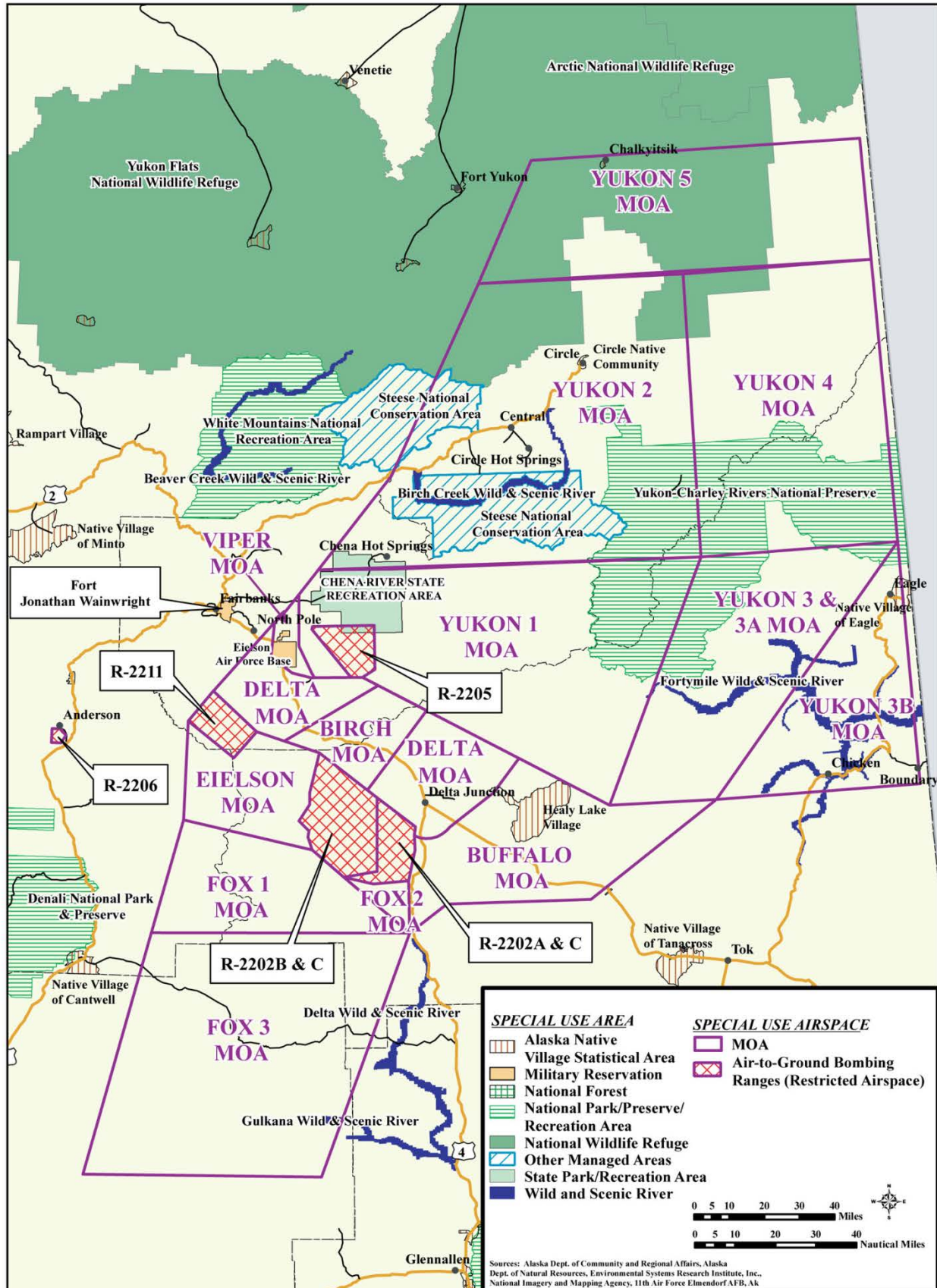


Figure 3.8-4. Special Use Areas Underlying Restricted Areas and MOAs

3.0 Affected Environment**3.9.1 *Base Socioeconomic Existing Conditions***

JBER is situated in south-central Alaska, just north of Anchorage. Socioeconomic activities associated with the base are concentrated in the Municipality of Anchorage, which comprises the ROI for this analysis. Available socioeconomic characteristics are addressed for the base population and for the Municipality of Anchorage.

3.9.1.1 *Population and Housing*

The combination of Elmendorf AFB with Fort Richardson as JBER has resulted in one installation with approximately 12,000 military and 4,000 civilian and non-appropriated funds employees (JBER 2009). There are approximately 30,000 dependents associated with JBER personnel. Approximately 10,000 residents, military personnel, and their family members are on base in military housing, including privatized housing. The majority of military personnel, civilian personnel, and their families reside off-base within the Municipality of Anchorage, including the communities of Chugiak and Eagle River.

The 2009 population of the Municipality of Anchorage was 287,460 persons. This is an increase from 2000 to 2009 at an average annual rate of 1.0 percent. Population in the municipality is projected to increase at an average annual rate of 0.7 percent to 297,416 persons by the year 2014 (Department of Commerce 2010). Anchorage is the largest city in Alaska, accounting for approximately 45 percent of the state population. The average household size in the municipality is 2.75 persons. Almost 94 percent of the 111,136 housing units are occupied, yielding a vacancy rate of 6.0 percent or approximately 6,700 vacant units. By comparison, the vacancy rate statewide is 15 percent, primarily due to seasonal occupancy.

3.9.1.2 *Economic Activity*

Anchorage is the center of commerce for the state of Alaska, an economy driven by four major sectors: oil/gas, military, transportation, and tourism. These sectors have provided a level of stability to the region during the national economic downturn experienced during the end of the last decade. A number of industries are headquartered in Anchorage, including oil and gas enterprises, finance and real estate, transportation, communications, and government agencies.

JBER is an important contributor to the Anchorage economy through employment of military and civilian personnel and expenditures for goods and services. The value of goods and services contracts was approximately \$811 million in 2009 with approximately \$85 million spent annually on consumable goods (JBER 2009).

In the Municipality of Anchorage, total full- and part-time employment was 144,307 jobs in third quarter 2010. The largest employment sectors have been government (21.6 percent), retail trade (11.3 percent), and health care and social services (10.6 percent) (U.S. Bureau of Economic Analysis 2005). Military and military-related civilian employment, including the National Guard, account for approximately 18,000 jobs in Anchorage, representing approximately 12 percent of total employment.

At the end of 2010 the unemployment rate in Anchorage was 6.7 percent. There are seasonal fluctuations related to resource usage, including commercial fishing and processing activities.

Average unemployment in Anchorage was 5.7 percent in 2003, and unemployment fluctuated between 4.1 percent and 7.4 percent during the decade from 1990-2000.

3.9.1.3 *Public Services*

Daily operation of JBER and furnishing of services and support to base personnel and family members is the responsibility of the 673d Air Base Wing, the base host unit. Off-base public services are provided by a number of public and private entities. Police and fire protection services are provided by the Anchorage Police and Fire Departments, respectively. Anchorage Regional Hospital and various medical care providers offer health services in the area. The 673^d Medical Group, in collaboration with the Veterans Administration, provides JBER hospital and medical care. There are approximately 20,000 military retirees in the region.

The Anchorage school district serves the JBER population, including three elementary schools, one middle school, and one high school. JBER provides youth programs, teen centers, and childcare services for military families residing and working on base.

3.9.2 *Training Airspace Socioeconomic Existing Conditions*

Socioeconomic resources evaluated include areas around JBER as well as geographic areas under or proximate to the training airspace. The nine geographic areas identified on Figure 1.1-1 are:

- Anchorage Municipality – not under training airspace;
- Bethel Census Area – partially under Stony MOAs;
- Dillingham Census Area – partially under Naknek MOAs;
- Fairbanks Northstar Borough – rural portions partially under Yukon MOAs and Viper A/B MOA;
- Lake and Peninsula Borough – partially under Naknek 2 MOA;
- Matanuska-Susitna Borough – rural portions partially under Susitna and Fox MOAs;
- Southeast Fairbanks Census Area – partially under Yukon, Birch, and Buffalo MOAs;
- Valdez-Cordova Census Area – not under training airspace; and
- Yukon-Koyukuk Census Area – partially under Galena and Stony MOAs.

3.9.2.1 *Population and Housing*

Lands under training airspace are very rural in nature, with sparsely scattered populations. Population data from the 2000 census provide for a consistent comparison among geographic areas. The 2010 census data are not expected to be available before summer 2011.

With the exception of Anchorage Municipality, Fairbanks North Star, and the Matanuska-Susitna Borough, rural lands comprise two-thirds of the region. Rural population density is 0.4 to less than 0.1 persons per square mile (see Table 3.9-1). The population centers are included for reference although they are not directly affected by training airspace. The average

3.0 Affected Environment

household size in the regions ranges from 2.80 persons per household in the southeast Fairbanks census area to 3.73 persons per household in the Bethel census area. By comparison, the state and Anchorage average household sizes are 2.74 and 2.62 persons per household, respectively. Housing vacancy rates range from a low of 18.5 percent in Bethel to a high of 62.2 percent in Lake and Peninsula Borough. The vacancy rates are primarily due to seasonal occupancy.

Table 3.9-1. Demographic Characteristics of Affected Regions (2000)

<i>Affected Region</i>	<i>Total Population</i>	<i>Percent Rural</i>	<i>Population Density</i>	<i>Average Household Size</i>	<i>Housing Vacancy Rate</i>
State of Alaska	626,932	34.4	1.1	2.74	15.1
Anchorage Municipality	260,283	3.9	153.4	2.67	5.5
Bethel Census Area	16,006	72.3	0.4	3.73	18.5
Dillingham Census Area	4,922	100.0	0.3	3.20	34.4
Fairbanks North Star Borough	82,840	30.4	11.2	2.68	10.6
Lake and Peninsula Borough	1,823	100.0	0.1	3.10	62.2
Matanuska-Susitna Borough	59,322	64.5	2.4	2.84	24.8
Southeast Fairbanks Census Area	6,174	100.0	0.2	2.80	34.9
Valdez-Cordova Census Area	10,195	100.0	0.3	2.58	24.6
Yukon-Koyukuk Census Area	6,551	100.0	<0.1	2.81	41.1

Source: U.S. Bureau of the Census 2000a.

3.9.2.2 Economic Activity

Economic activity in the regions away from population centers revolves primarily around Alaska's natural resources. Government and government enterprises provide many jobs in these regions and provide a measure of stability through year-round employment. Seasonal employment that includes commercial fishing, guided hunting, and related industries are an important source of income. Population in many of these areas fluctuates throughout the year in response to seasonal activity. Resource-based tourism, mining, and oil/gas pursuits also contribute to regional economic activity. For many residents, subsistence fishing and hunting are important and contribute substantially to people's diets and supplementary income.

Seasonal unemployment rates vary widely in the regions in response to fluctuations in resource-based employment. Average annual unemployment rates varied from 4.7 percent in Anchorage Municipality to 12.5 percent in the Yukon-Koyukuk Census Area, in comparison to the state's average unemployment rate of 6.1 percent (see Table 3.9-2). Median household income and per capita personal income vary considerably. With approximately 45 percent of the state's population in the Municipality of Anchorage, the household and personal income of Anchorage dominate the statistics. Most rural regions experience income levels lower than Anchorage or Anchorage-driven average state levels.

Table 3.9-2. Economic Characteristics of Regions (2000)

<i>Regions</i>	<i>Total Employment</i>	<i>Percent Unemployment</i>	<i>Median Household Income</i>	<i>Per Capita Personal Income</i>
State of Alaska	281,532	6.1	\$51,571	\$22,660
Anchorage Municipality	125,737	4.7	\$55,546	\$25,287
Bethel Census Area	5,481	9.1	\$35,701	\$12,603
Dillingham Census Area	1,765	7.2	\$43,079	\$16,021
Fairbanks North Star Borough	35,258	5.8	\$49,076	\$21,553
Lake and Peninsula Borough	581	7.9	\$36,442	\$15,361
Matanuska-Susitna Borough	24,981	6.7	\$51,221	\$21,105
Southeast Fairbanks Census Area	1,932	9.5	\$38,776	\$16,679
Valdez-Cordova Census Area	4,463	6.3	\$48,734	\$23,046
Yukon-Koyukuk Census Area	2,276	12.5	\$28,666	\$13,720

Source: U.S. Bureau of the Census 2000b.

3.9.2.3 Public Services

A review of Figure 2.2-2 demonstrates the rural nature of areas under training airspace. In many cases the only access to these areas is by boat or aircraft. Public services are either available locally or may be obtained through air transport. In some areas practically everything from groceries to medical services are provided by Alaska civil aviation. The Internet has successfully connected residents in many remote areas to Alaska education and other public services.

3.10 Environmental Justice

EO 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs federal agencies to address environmental and human health conditions in minority and low-income communities. In addition to environmental justice issues are concerns pursuant to EO 13045, *Protection of Children from Environmental Health Risks and Safety Risks*, which directs federal agencies to identify and assess environmental health and safety risks that may disproportionately affect children.

For purposes of this analysis, minority, low-income and youth populations are defined as follows:

- *Minority Population:* Alaska Natives, persons of Hispanic origin of any race, Blacks, American Indians, Asians, or Pacific Islanders.
- *Low-Income Population:* Persons living below the poverty level.
- *Youth Population:* Children under the age of 18 years.

Estimates of these three population categories were developed based on data from the U.S. Bureau of the Census. The census does not report minority population, per se, but reports population by race and by ethnic origin. These data were used to estimate minority populations potentially affected by implementation of the Proposed Action. Low-income and youth population figures also were drawn from the Census 2000 Profile of General Demographic Characteristics.

3.0 Affected Environment**3.10.1 *Base Environmental Justice Existing Conditions***

JBER is situated in south-central Alaska, just north of Anchorage. Land situated outside the JBER boundaries but within the 65 L_{dn} or greater noise contour consists of two affected geographic areas with a total of 59.1 acres. This area is compatible industrial with a small (0.5 acre) rural piece of land across the Knik Arm. The community of Mountain View, south of the JBER-Elmendorf airfield and comprised primarily of minority and low-income residents, is outside the 65 dB L_{dn} noise contour.

Ethnicity and poverty status in the vicinity of JBER-Elmendorf were examined and compared to state and national data. Minority persons represent 30.1 percent of the Municipality of Anchorage population (U.S. Bureau of the Census 2000a). Alaska Natives represent 7.0 percent of the Anchorage population and 23.4 percent of the minority population. By comparison, minority persons represent 32.4 percent of the state population, with Alaska Native accounting for 47.5 percent of the state minority population.

The incidence of persons and families in the Municipality of Anchorage with incomes below the poverty level was comparable to state levels. In Anchorage during 2000, 7.3 percent of persons were living below the poverty level, compared to 9.4 percent of persons in the state and 12.4 percent of persons in the nation (U.S. Census 2005).

The number of children under age 18 was determined for the vicinity of JBER-Elmendorf and compared to state and national levels. In 2000, there were 75,742 children age 17 and under residing in Anchorage, comprising 29.1 percent of the population. This compares to 30.4 percent for the State of Alaska and 25.7 percent for the nation.

The community of Mountain View is located south of JBER-Elmendorf (see Figure 3.8-1). The minority population of Mountain View is a greater share of the total population than in the Municipality of Anchorage (68 percent vs. 30 percent). The ratio of low-income individuals residing in Mountain View is greater than city and state levels. The median annual household income for Mountain View was \$42,469 in 2008 as compared with \$75,637 for Anchorage as a whole. An estimated 23.5 percent of the Mountain View population is below the poverty level as compared with 7.3 percent of Anchorage. The Mountain View Elementary School has an enrollment of 339 students, of whom 88 percent are considered economically disadvantaged.

3.10.2 *Training Airspace Environmental Justice Existing Conditions*

As with socioeconomic resources, evaluation of environmental justice evaluates nine geographic areas that include areas under the affected airspace and large municipalities near the airspace:

- Anchorage Municipality – not under training airspace;
- Bethel Census Area – partially under Stony MOAs;
- Dillingham Census Area – partially under Naknek MOAs;
- Fairbanks Northstar Borough – rural portions partially under Yukon MOAs and Viper A/B MOA;

- Lake and Peninsula Borough – partially under Naknek 2 MOA;
- Matanuska-Susitna Borough – rural portions partially under Susitna and Fox MOAs;
- Southeast Fairbanks Census Area – partially under Yukon, Birch, and Buffalo MOAs;
- Valdez-Cordova Census Area – not under training airspace; and
- Yukon-Koyukuk Census Area – partially under Galena and Stony MOAs.

Alaska Natives live on many land areas under the affected airspace. Specific communities are identified under specific airspace units in Figure 3.7-2. Federally recognized Alaska Natives under the airspace include Crooked Creek, settled by Eskimo and Ingalik people; Georgetown, a seasonal fishing village; Lime village, a Dena'ina Athabascan Indian settlement; Red Devil, a village populated by a mix of Eskimo, Athabascan, and non-native inhabitants; Sleetmute, founded by Ingalik Indians; Stony River, a mix of Indian and Eskimo people; and Koliganek (U.S. Bureau of the Census 2000a). Other federally recognized Alaska Native populations in the area include Eagle, Circle, Chalkyitsik, Dot Lake, and Healy Lake. Native lifestyle in many of these villages is based on, or supplemented by, subsistence activities. Alaska Native Corporations in the region are Cook Inlet, Calista, Doyon, and Bristol Bay. Additional baseline data on minority, low-income, and youth populations in areas under the airspace are presented in Table 3.10-1.

Based on 2000 Census data, the incidence of persons and families in the rural areas with incomes below the poverty level generally exceeded Anchorage-dominated state levels (see Table 3.10-1). Poverty rates in the affected regions under the training airspace ranged from a low of 18.9 percent in Lake and Peninsula and southeast Fairbanks to a high of 23.8 percent in Yukon-Koyukuk Census Area, compared to 7.3 percent of persons in Anchorage and 9.5 percent of persons in the Anchorage-dominated state totals.

Table 3.10-1. Minority and Low-Income Populations by Area (2000)

<i>Area</i>	<i>Total Population</i>	<i>Percent Low-Income</i>	<i>Percent Minority</i>	<i>Percent Alaska Native</i>	<i>Percent Youth</i>
State of Alaska	626,932	9.4	32.4	15.4	30.4
Anchorage Municipality	260,283	7.3	30.1	7.0	29.1
Bethel Census Area	16,006	20.6	87.8	81.6	39.8
Dillingham Census Area	4,922	21.4	79.1	69.4	38.1
Fairbanks North Star Borough	82,840	7.8	24.0	6.8	30.1
Lake and Peninsula Borough	1,823	18.9	81.2	73.0	37.8
Matanuska-Susitna Borough	59,322	11.0	13.7	5.3	32.2
Southeast Fairbanks Census Area	6,174	18.9	22.6	12.6	32.8
Valdez-Cordova Census Area	10,195	9.8	25.3	13.0	29.6
Yukon-Koyukuk Census Area	6,551	23.8	76.0	70.4	35.0

Source: U.S. Bureau of the Census 2000a, 2005.

Minority persons represent between 22.6 percent and 87.8 percent of the population under the training airspace. Alaska Natives are by far the largest minority group, accounting for nearly the entire minority population and comprising over two-thirds of the total population in some areas under the training airspace. By comparison, minority persons represent 32.4 percent of the state population, with Alaska Natives accounting for 15.4 percent of the state total.

3.0 Affected Environment

population and 47.5 percent of the state minority population. Youths under the age of 18 comprise between 32.8 percent and 39.8 percent of the population under the airspace, compared to 30.4 percent at the state level and 29.1 percent in Anchorage.

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4.0 BASE AND TRAINING AIRSPACE ENVIRONMENTAL CONSEQUENCES

This chapter analyzes potential environmental consequences from the proposed plus-up of the F-22 aircraft inventory at JBER. As in Chapter 3.0, the expected geographic scope of potential environmental consequences is identified as the ROI. This chapter considers the direct and indirect effects of the Proposed Action and No Action Alternative described in Chapter 2.0. The *Existing Conditions* (refer to Chapter 3.0) of each relevant environmental resource is described to give the public and agency decision makers a meaningful point from which they can compare potential future environmental, social, and economic effects. Cumulative effects are discussed in Chapter 5.0.

For the purpose of this EA, the term JBER refers to the entire combined base. The term JBER-Elmendorf refers to the historic Elmendorf AFB which is primarily affected by the F-22 plus-up. JBER- Richardson refers to the historic Fort Richardson portion of JBER.

4.1 Airspace Management

Airspace management environmental consequences could occur in or around the base or in the training airspace.

4.1.1 Base Airspace Management Environmental Consequences

The addition of six primary F-22 aircraft to JBER-Elmendorf would not impact air traffic control within the AATA. The Anchorage Approach Control has overall management responsibility within the ATCAA. Anchorage Approach Control has managed the airspace when there were substantially more fighter aircraft operating from JBER-Elmendorf than would be with the proposed F-22 plus-up. No consequences would be expected to airspace management with the additional six primary F-22 aircraft.

4.1.2 Training Airspace Environmental Consequences

Table 2.2-3 in Chapter 2.0 describes the existing and projected MOA usage associated with baseline F-22 and the proposed increase of six primary aircraft. F-22 training in the MOAs would be similar to the existing use by F-22 aircraft. The additional aircraft would not affect regional airspace management. The usage of the airspace would not change to the extent that civil aviation could be affected. The time spent at higher altitudes by the F-22, including in the ATCAAs, should have a minimal effect upon general aviation that normally flies at lower altitudes.

Range use by the F-22 is substantially less than historic use by such aircraft as the F-15E. The F-22 is designed to carry smart munitions with long range stand-off capabilities. Most air-to-ground training in the airspace would be performed by flying specific training profiles and practicing the release of munitions under launch conditions without actually releasing any munitions. Practice munitions use could occur on Alaskan training ranges and would be performed at lower altitudes to experience the handling characteristics of the aircraft under deployment conditions. Table 2.2-4 presents the existing and projected F-22 training munitions

use. None of the training activities within Alaskan SUA would be expected to result in any changes to airspace management from those existing for the F-22 training. The mitigations in the 1995 MOA EIS ROD still apply (Air Force 1995). During studies conducted as part of the MOA EIS, it was found that dissemination of information is an important element in explaining airspace management and use.

Alaska residents, including Alaska Natives, have expressed concerns that military aircraft training could potentially conflict with small aircraft serving communities under special use airspace. Enhanced F-22 electronics and situational awareness reduce risks of conflicts with general aviation. Existing awareness and avoidance procedures implemented by the Air Force, and standard FAA flight rules are designed to prevent airspace conflicts. These FAA rules require that all pilots are responsible to apply “see and avoid” techniques when operating an aircraft. To reduce the potential for airspace conflicts, JBER continues to schedule MFEs in training airspace to avoid the high recreation period from the 27th of June to the 11th of July. MFEs are also not scheduled during January, September, or December.

4.1.3 No Action

Existing terminal airspace, MOA, range, and other airspace usage would not change with the No Action. F-22s would continue to train from JBER-Elmendorf and continue to train in the airspace as they do today.

4.2 Noise

This section describes noise impacts associated with the proposed F-22 plus-up in the area near JBER-Elmendorf and in military training airspace units. Impacts are assessed by comparing noise conditions under the Proposed Action and the No Action Alternative to baseline conditions.

4.2.1 Base Environmental Consequences

Noise levels near JBER-Elmendorf were calculated using the established and tested noise program, NOISEMAP. Under the Proposed Action, all operational procedures currently in effect, including noise-related operational restrictions, runway usage patterns, and approach and departure procedures, would remain in effect. These procedures include use of Runway 34 (northbound crosswind runway) for approximately 25 percent of F-22 departures. The runway typically used for F-22 arrivals is runway 06 (eastbound main runway). To represent F-22 operations under the Proposed Action for the purposes of noise modeling, current F-22 aircraft operations were increased by the proportion of additional F-22 plus-up aircraft. This would result in an average of approximately five additional daily F-22 sorties.

The increase of F-22 aircraft with the plus-up results in 16.7 percent more F-22s being based at JBER-Elmendorf. The additional personnel capability at JBER-Elmendorf would be expected to proportionately increase the F-22 sorties.
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4.2.1.1 Land Areas

Table 4.2-1 compares the total area, in acres, exposed to each noise contour interval under baseline and proposed conditions. Figure 4.2-1 shows the noise contours under the Proposed Action and baseline conditions.

The total land and water area exposed to 65 dB L_{dn} or more would be projected to increase from 13,506 acres under current conditions to 14,386 acres under the proposed plus-up. The increase of approximately 880 acres represents a 6.5 percent increase.

Table 4.2-1. Areas Exposed to Noise Intervals Under Baseline Conditions and the Proposed Action

Location	Condition	Area (In Acres) Exposed to Indicated Noise Levels (In L_{dn})					
		65-70	70-75	75-80	80-85	>85	Total
JBER	Baseline	5,534.7	2,374.2	1,009.7	496.4	457.0	9,872.0
	Proposed	5,665.8	2,580.1	1,065.7	532.6	489.8	10,334.0
	Change	131.1	205.9	56.0	36.2	32.8	462.0
Knik Arm/ Cook Inlet (Water)	Baseline	3,062.5	465.6	47.0	0.0	0.0	3,575.1
	Proposed	3,352.4	580.1	53.3	0.0	0.0	3,985.8
	Change	289.9	114.5	6.3	0.0	0.0	410.7
Port of Anchorage	Baseline	42.2	11.8	4.6	0.0	0.0	58.6
	Proposed	47.0	13.3	4.9	0.0	0.0	65.2
	Change	4.8	1.5	0.3	0.0	0.0	6.6
Land West of Knik Arm	Baseline	0.5	0.0	0.0	0.0	0.0	0.5
	Proposed	0.7	0.0	0.0	0.0	0.0	0.7
	Change	0.2	0.0	0.0	0.0	0.0	0.2
Total	Baseline	8,639.9	2,842.6	1,061.3	496.4	457.0	13,506.2
	Proposed	9,065.9	3,173.5	1,123.9	532.6	489.8	14,385.7
	Change	426.0	321.9	62.6	36.2	32.8	879.5

Source: Wasmer and Maunsell 2005.

Of the approximately 880 additional acres that would be affected by noise levels greater than 65 dB L_{dn} under the Proposed Action, 462 acres would occur on JBER. The remainder of the area newly affected by noise levels greater than 65 dB L_{dn} would occur on the Knik Arm, in the Port of Anchorage, and in land west of the Knik Arm. Noise levels exceeding 65 dB L_{dn} would not extend beyond base boundaries to the south of the installation under the Proposed Action. DoD and FAA have determined that residential use is normally compatible with noise levels less than 65 dB L_{dn} . Satellite imagery demonstrates that the additional 6.6 acres affected by noise exceeding 65 dB L_{dn} in the Port of Anchorage area are vacant or in industrial uses. The Port of Anchorage is a compatible land use under the projected noise contours. A very small amount of land west of the Knik Arm (approximately 0.7 acre or 0.2 additional acre) would be affected by noise levels greater than 65 dB L_{dn} . Satellite imagery shows this area to be vacant shoreline.

Areas of relatively sensitive land uses on JBER (administrative/industrial, community support, and residential) are shown in Figure 4.2-2 in relation to baseline and Proposed Action noise contours. The total acreage in each of these land use categories affected by greater than 65 L_{dn} is listed in Table 4.2-2.

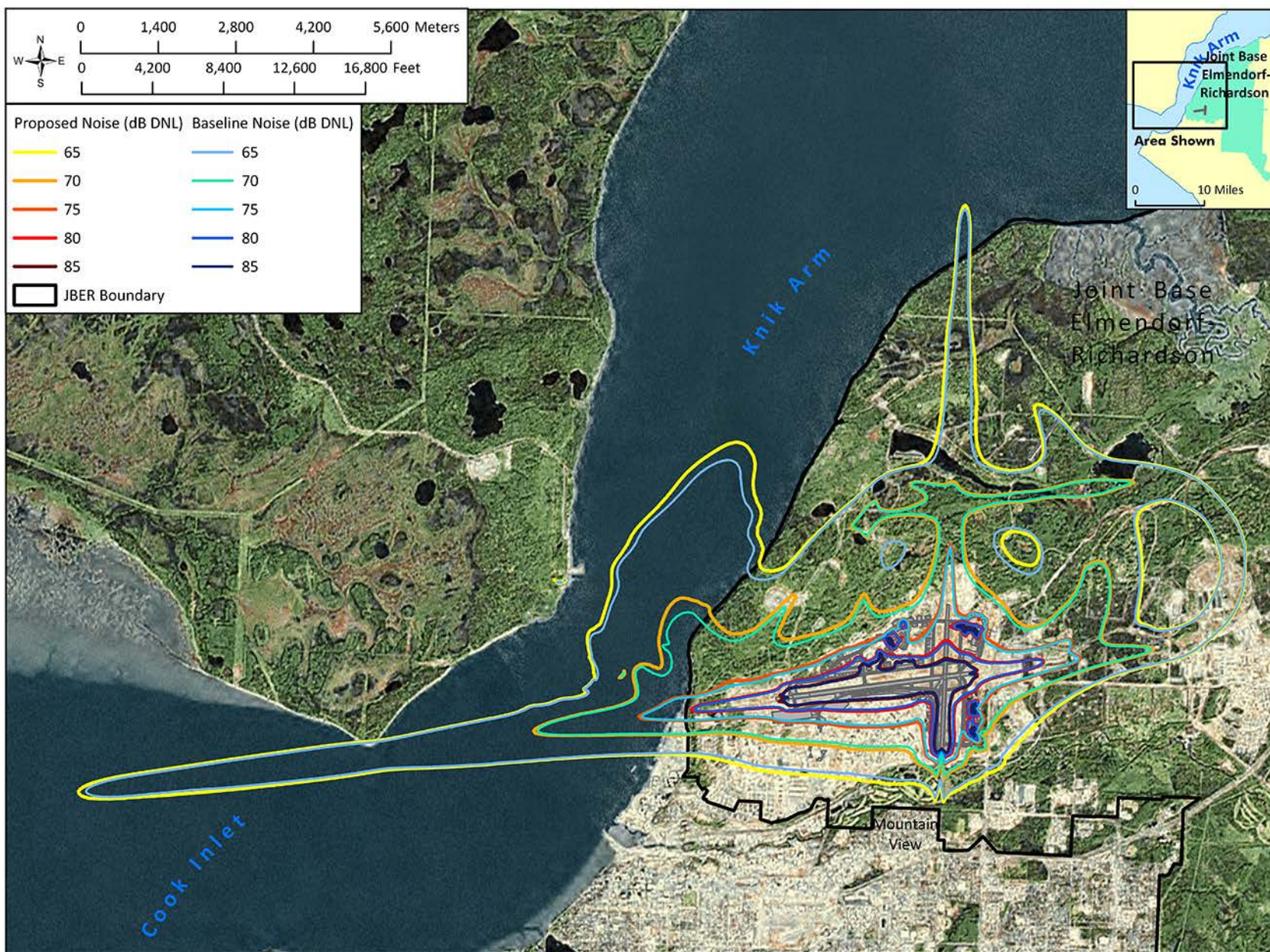


Figure 4.2-1. Baseline and Proposed Action Noise Contours

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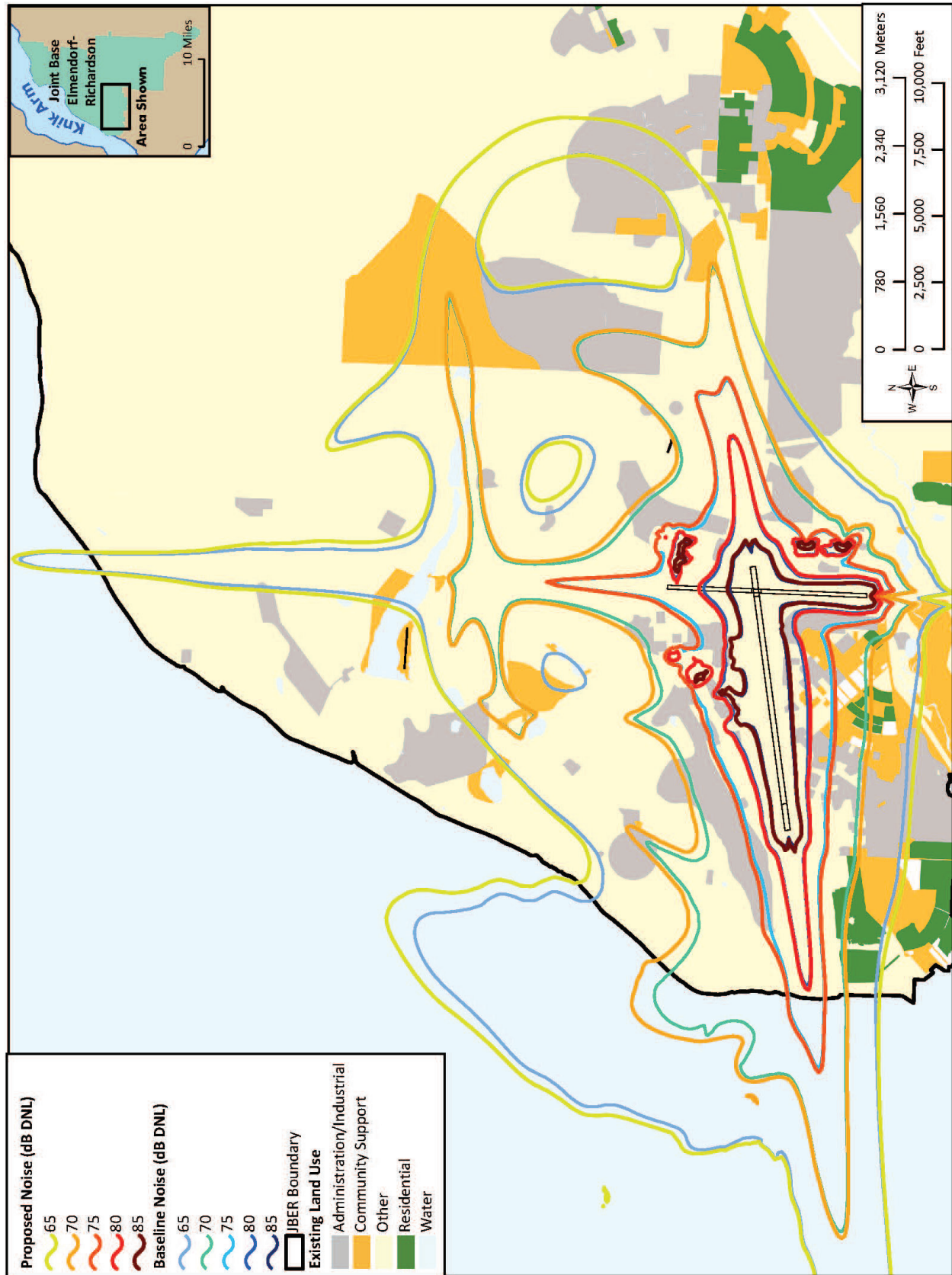


Figure 4.2-2. Land Use and Noise Contours Under Baseline Conditions and the Proposed Action

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Under the Proposed Action, the number of on-base residential structures exposed to noise greater than 65 L_{dn} would increase by 24 from 157 to 184. Increases in noise levels would be expected to result in minor increases in the prevalence of annoyance in affected persons on JBER. However, structural attenuation would reduce the level of impacts to persons indoors. Furthermore, annoyance generated by aircraft noise may be somewhat less likely on a military reservation than in other locations due to the affected population generally viewing military training as being necessary and important.

Table 4.2-2. Acres on JBER in Several Land Use Categories Impacted by Noise Greater Than 65 L_{dn}

<i>Land Use Category</i>	<i>Baseline</i>	<i>Proposed</i>	<i>Change</i>
	<i>Acres ≥ 65 dB L_{dn}</i>		
Administrative/ Industrial	2,040	2,120	80
Community Support	817	878	60
Residential (Accompanied and Unaccompanied)	199	202	3

As per a DoD policy memorandum published in 2009, populations exposed to noise greater than 80 dB L_{dnmr} are at the greatest risk of population hearing loss (Undersecretary of Defense for Acquisition Technology and Logistics 2009). No on- or off-base residences are exposed to noise levels greater than 80 dB L_{dnmr} and, therefore, hearing loss risk for on- or off-installation residents is relatively low. Noise levels in the JBER-Elmendorf flightline exceed 80 dB L_{dnmr} under baseline conditions and would continue to exceed 80 dB L_{dn} under the Proposed Action. Under the Proposed Action, noise generated by the six additional F-22 aircraft would cause the 80 L_{dn} contour line to shift outwards from the runway by 50- to 100 feet. This shift would cause 11 buildings previously exposed to slightly less than 80 L_{dn} to be exposed to slightly greater than 80 L_{dn} , increasing the total buildings on JBER exposed to greater than 80 L_{dn} from 52 to 63. The 11 buildings newly within the 80 L_{dn} contour include five buildings directly related to aircraft operations, two storage buildings, a chapel, and three administrative buildings.

In accordance with existing policies and regulatory guidance, the JBER Bioenvironmental Engineering Office assesses expected potential for occupational hearing loss risk and conducts health risk assessment, as described in Section 3.2.2.1, where it is deemed necessary. The JBER Bioenvironmental Engineering Office considers several factors, including structural noise attenuation and the amount of time workers spend outside when deciding on the appropriate course of action. Hearing protection devices used to protect worker's hearing would be the same (e.g., earmuffs, earplugs) as are used currently on JBER to protect workers in known high noise environments. The potential hearing loss risk among workers on JBER would be managed according to DoD guidelines. Workers on JBER are protected against possible noise impacts by adherence to DoD noise management guidelines. The JBER Bioenvironmental Engineering Office will review conditions of the additional 11 buildings exposed to greater than 80 L_{dn} , and will implement all protective measures required by Air Force occupational safety regulations.

4.2.1.2 Knik Arm

Underwater noise levels in the Knik Arm associated with individual aircraft overflights would not increase under the Proposed Action, as existing F-22 flight procedures would not change. However, the frequency of occurrence of these events would increase and this increase could

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potentially have negative consequences for animals living in the Knik Arm. Of particular concern would be any impacts to the CIBW, which was recently listed as endangered under Section 7 of the ESA. An in-depth analysis was conducted to assess risk to the CIBW resulting from additional F-22 flying operations. This analysis is described in Section 3.2, and in greater detail in Section 4.6, (Biological Resources) and Appendix E, *Section 7 (Endangered Species Act) Compliance Wildlife Analysis for F-22 Plus Up Environmental Assessment*. The analysis found that implementation of the Proposed Action has the potential to increase the number of CIBW behavioral harassments by approximately 0.04 events annually. As discussed in Section 4.6, the NMFS has determined this increase may affect but is unlikely to adversely affect the CIBW.

Overall, noise impacts in the base vicinity associated with implementation of the Proposed Action would not be expected to be perceived as significant.

4.2.2 Training Airspace Environmental Consequences

The program MR_NMAP was used to calculate subsonic L_{dnmr} in the training airspace units under baseline conditions and the Proposed Action. Under the Proposed Action, F-22 aircraft would not fly in any airspace units that are not being used by the F-22 currently. Furthermore, F-22 aircraft would conduct training in the same altitude bands used currently, and sortie-operations conducted after 10:00 p.m. would continue to be rare. The only change expected to occur relative to baseline conditions would be an increase in the annual number of F-22 sortie operations proportionate to the number of plus-up aircraft. Baseline conditions reflect the relocation of the Kulis ANG to JBER and the recent departure of the 19 FS, which had operated F-15C aircraft.

The change in L_{dnmr} between baseline conditions and the Proposed Action would be 1 dB or less (Table 4.2-3). To put this degree of change in perspective, changes in instantaneous noise levels of less than 3 dB are typically not noticeable in non-laboratory conditions. Under the Proposed Action, noise levels beneath all training airspace units except Eielson and Viper MOAs would be below 55 dB L_{dnmr} , the USEPA-identified threshold below which impacts to human health and welfare are not expected to occur (USEPA 1974). Noise levels beneath Eielson and Viper MOAs would increase by 1 dB to 59 and 57 dB L_{dnmr} , respectively. This increase would not be discernible to residents or visitors to the area.

F-22 aircraft training in the MOAs and ATCAAs would fly supersonic at the same altitudes, the same number of times per sortie, and for the same length of time per sortie as current F-22 sortie-operations in the training airspace. As F-22 operations would increase, the number of F-22 supersonic events would also increase by approximately the same percentage. Data on the current and proposed flying operations of the F-22 and other supersonic-capable aircraft using the training airspace were entered into the program BOOMAP to generate CDNL beneath each airspace unit. Increases in CDNL would be 1 dB or less and would be 54 dB L_{dnmr} or less (Table 4.2-3).

The enhanced supersonic performance of the F-22, which contributes to its success in combat, means that F-22 sortie-operations result in more sonic booms on average than sortie-operations conducted by fourth generation fighter aircraft currently operating in the training airspace (e.g., F-16 Aggressor aircraft flying from Eielson AFB). Recordings made during multiple air-to-air

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sortie-operations indicate that approximately 7.5 percent of F-15C aircraft sortie-operations involve supersonic flight, with approximately one supersonic flight segment per sortie operation on average (Plotkin *et al.* 1989, Plotkin *et al.* 1992, Frampton *et al.* 1993, Page *et al.* 1994). The F-22 is estimated to fly supersonic during approximately 25 percent of sortie operations, with one supersonic flight segment per sortie operation on average. While every aircraft flying at supersonic speeds generates a sonic boom, not all sonic booms reach the ground. In the training airspace, an average of approximately 42 percent of supersonic events would result in a sonic boom being experienced on the ground. Under the Proposed Action, the average number of supersonic flight events and sonic booms experienced per month at any given location on the ground near the center of the airspace units would increase by one to three additional sonic booms per month (Table 4.2-3).

Table 4.2-3. Noise Levels Under Baseline Conditions and the Proposed Action

MOA/ ATCAA	Baseline				Projected			
	L _{dnmr}	CDNL	Supersonic Events/ Month	Booms/ Month (at ground)	L _{dnmr}	CDNL	Supersonic Events/ Month	Booms/ Month (at ground)
Delta	<45	50	23.8	10	<45	50	25.7	10.8
Eielson ¹	58	54	63	26.5	59	54	69.6	29.2
Fox 1/2/3 ⁵	51	54	63	26.5	52	54	69.6	29.2
Galena ¹	<45	N/A	N/A	N/A	<45	N/A	N/A	N/A
Naknek 1/2 ¹	<45	41	3.6	1.5	<45	42	4	1.7
Stony A/B ²	52	52	43.2	18.1	53	53	51.2	21.5
Susitna ³	<45	N/A	N/A	N/A	<45	N/A	N/A	N/A
Viper ⁴	56	N/A	N/A	N/A	57	N/A	N/A	N/A
Yukon 1 ⁵	45	51	35	14.7	46	51	37	15.5
Yukon 2 ⁵	45	50	28.4	11.9	45	51	30.4	12.8
Yukon 3 ⁵	44	50	26	10.9	45	50	28	11.8
Yukon 4 ⁵	45	49	25.3	10.6	46	50	27.4	11.5
Yukon 5 ⁵	44	50	24.4	10.3	45	50	26.4	11.1

Notes:

1. ATCAAs supersonic approved above 30,000 MSL.
2. Supersonic approved above 10,000 MSL or 5,000 AGL (whichever is higher).
3. Supersonic approved ONLY for Functional Check Flights above 12,000 MSL or 5,000 AGL (whichever is higher) on an East-West line south of Denali Reserve.
4. Supersonic not approved.
5. Supersonic approved above 12,000 MSL or 5,000 AGL (whichever is higher).

The largest increase in sonic booms would occur beneath the primary airspace units (Naknek 1/2 and Stony A/B MOAs). Near the center of the Naknek MOAs, the number of sonic booms would increase from an average of 1.5 per month (one boom per 20 days) to an average of 1.7 per month (one boom per 17 days). Toward the center of Stony A/B MOAs, the number would increase from 18 sonic booms per month (one boom per 1.7 days) to an average of 22 sonic booms per month (one boom per 1.4 days). This estimated change may be noticed by residents or long-term visitors. Such a change in sonic events would not be expected to affect human health or have an effect upon game or other animals which have experienced sonic booms for

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most of their lifetimes. If the increase were to be perceived by a resident or long-term visitor under the airspace, it could cause annoyance.

The number of sonic booms near the center of Eielson MOA and Fox 1 and 2 MOAs would increase from 27 per month to 29 per month. Near the center of Fox 3 MOA, the number of booms per month would be calculated to increase from 25 to 28. Near the center of Yukon 1 MOA, the average number of booms per month would increase from 15 to 16, and the number experienced per month near the center of Yukon 2 MOA would increase from 12 to 13. Near the center of Yukon 3 and 4 MOAs, the average monthly number of sonic booms experienced would increase from 11 to 12, and near the center of Yukon 5 MOA, the number would increase from 10 to 11. If perceived, the increase may be considered annoying.

This change could be discernible to Alaska Natives or others residing under or using the land under the airspace for an extended period of time. For any damage claims associated with sonic booms, the Air Force has established procedures that begin with contacting the JBER Public Affairs Office.

Overall, sub- and supersonic noise impacts in the military training airspace associated with implementation of the Proposed Action would not be expected to be perceived as significant.

4.2.3 No Action

Under the No Action Alternative, the F-22 plus-up would not occur. Noise levels around the airfield (on land and in the Knik Arm) and in the military training airspace would remain as discussed in Section 3.2.

4.3 Safety

This section addresses potential environmental consequences to ground, flight, and explosive safety that could occur at or in the vicinity of JBER-Elmendorf or within the training airspace.

4.3.1 Base Environmental Consequences

Six additional primary F-22 aircraft would essentially function as the existing F-22 aircraft that have been flying at JBER-Elmendorf for the past four years. JBER-Elmendorf aircraft ground safety conditions would not change as a result of the F-22 plus-up.

Historically, when new military aircraft first enter the inventory, the flight safety mishap rate is higher. Safety data are limited for the F-22 because it is a new aircraft with multiple complex systems. These systems are undergoing refinement as the F-22 accumulates flight hours as an operational system. Class A mishaps are calculated on a basis of 100,000 flight hours. The F-22 has nearly achieved 100,000 flight hours needed for a Class A impact calculation. During test activities and weapons system



JBER has an active BASH program to reduce the potential for bird and wildlife strikes and enhance airfield safety.

development, the F-22 had two Class A mishaps; there have been two Class A mishaps during the time the aircraft has been operational, one of which was in Alaska in 2010.

As the F-22 becomes operationally mature, the overall F-22 mishap rate is expected to become comparable to that of the F-15, a similarly sized aircraft with a similar mission. The long-term F-15 Class A mishap rate is 2.46 per 100,000 flight hours. Historical trends show that mishaps of all types decrease the longer an aircraft is operational, as operations and maintenance personnel learn more about the aircraft's capabilities and limitations. Some of this experience has already been gained for the F-22. Experience gained with F-22 test programs, training, and operations would continue to provide substantial knowledge about the F-22. Safety factors such as computer self checks and computer-enhanced maintenance will permit the F-22 to operate as safely as, if not more safely than, the F-15 (see Figure 3.3-2). As noted in Section 3.3.1.2, the estimated F-22 Class A mishap rate of 6.35 per 100,000 flight hours over eight years of test and operations is nearly identical to the F-15 Class A mishap rate over the F-15's first eight years of test and operations.

Since the additional F-22 aircraft would operate in the same airfield environment as existing F-22s, the overall potential for bird-aircraft or wildlife strikes would essentially be proportional to the aircraft assigned. The F-22 rapidly attains altitudes above where the majority of the strikes occur. Aircraft safety and bird-aircraft strikes are not expected to measurably differ from baseline conditions.

The amount of munitions associated with two F-22 squadrons with the plus-up is lower than that associated with the three F-15 squadrons which were relocated from JBER in 2006 and 2010. JBER has the personnel and facilities to handle the level of munitions, chaff, and flares associated with the additional aircraft.

The F-22 low visibility requirements do not include such items as a fuel dump valve that could provide a radar signature. The F-22 does not have the ability to dump fuel either in the vicinity of the airfield or in the training airspace.

4.3.2 Training Airspace Environmental Consequences

Within the training airspace, aircraft safety and bird-aircraft strikes with the additional six primary F-22s would not measurably differ from baseline conditions. All safety actions that are in place for existing F-22 training would continue to be in place for the additional aircraft. These actions include briefings during periods of heavy bird migration, scheduling to avoid, to the extent possible, high general aviation use of MOA airspace, and altitude restrictions on flare use. The F-22 pilot's improved situational awareness is expected to result in no safety impacts within the airspace. There would be no expected change in safety under the training airspace.

With the distribution of population under the airspace and the frequency of chaff and flare use, there would be nearly zero risk of a person being struck by a large hailstone-sized plastic S&I piece. There would be even less of a risk that a dud flare could strike a person or animal, with serious injury. An extremely rare dud flare is treated as ordinance if found on a training range. Should such an object be found, the location should be marked and JBER Public Affairs Office should be notified (see Appendix B).

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Additional F-22s training in the airspace would increase chaff or flare use by an estimated 16.7 percent over baseline F-22 use. Each chaff bundle used for F-22 training disperses chaff fibers thinner than a human hair, six 2-inch by 3-inch paper strips, and four plastic or nylon pieces. The chaff plastic pieces are inert. The parchment paper is expected to disintegrate over an Alaskan season. Chaff fibers are primarily silicon and aluminum, which are the most common elements of soil. Each flare has residual materials consisting of two plastic 2-inch by 2-inch pieces, one 2-inch by 1-inch by 1/2 -inch plastic S&I device, and an aluminum-coated mylar duct tape-type material from 1-inch by 1-inch up to 4-inches by 15- inches. No cases of animals ingesting chaff or flare materials have been recorded (Air Force 1997). No safety consequences from continued chaff and flare use are anticipated (see Appendix F).

4.3.3 No Action

Under the No Action Alternative, additional F-22 aircraft would not be assigned to JBER. F-22 aircraft would continue to fly from JBER-Elmendorf and train in Alaskan airspace using chaff and flares.

4.4 Air Quality

Air emissions resulting from the proposed F-22 plus-up were evaluated in accordance with federal, state, and local air pollution standards and regulations. Air quality impacts from a proposed activity or action would be significant if they:

- Increase ambient air pollution concentrations above any NAAQS;
- Contribute to an existing violation of any NAAQS;
- Interfere with or delay timely attainment of NAAQS; or
- Impair visibility within any federally mandated federal Class I area.

4.4.1 Base Environmental Consequences

According to USEPA's General Conformity Rule in 40 CFR Part 51, Subpart W, any proposed federal action that has the potential to cause violations in a NAAQS nonattainment or maintenance area must undergo a conformity analysis. Since JBER-Elmendorf is in attainment for all criteria pollutants, the anticipated emissions resulting from the Proposed Action have been analyzed, and it has been determined that the emissions would not cause or contribute to any new NAAQS violation (see Section 3.4.1). Furthermore, a conformity determination is not required, as the emissions for all pollutants are below the *de minimis* threshold established by the USEPA in 40 CFR 93.153.

PSD regulations protect the air quality in regions that already meet the NAAQS. The nearest PSD Class I area is approximately 100 miles from the region potentially affected by the Proposed Action. Therefore, the Proposed Action would be unlikely to have a significant impact on any PSD Class I areas.

The total Alaska military GHG emissions are 0.97 MMT CO_{2e} and represent five percent of the state total GHG emissions. The F-22 plus-up aircraft generate an estimated regional total of

9,257 tons per year of CO_{2e}. This would not be an addition to the global total of GHG because the F-22 aircraft would be contributing the same global amount if they were flying in New Mexico airspace. There would be no global GHG change and an estimated 0.95 percent increase in the military contribution to Alaska regional GHG emissions (see Section 3.4.1). The F-22 plus-up GHG regional contribution would not have a significant impact upon GHG emissions.

4.4.2 Training Airspace Air Quality Environmental Consequences

Table 2.2-3 describes the baseline and projected usage of the military training airspace under the Proposed Action. The projected change in aircraft operations represents an approximate 16.7 percent increase from the current use of F-22s. Emissions from aircraft operations would be transitory and dispersed over the extensive Alaskan SUA. No additional emissions would be detectible or measurable. Residents and visitors to Alaska Native villages and traditional subsistence areas underlying this airspace would not be able to detect any change in emissions associated with the Proposed Action.

Because more than 99.5 percent of F-22 flight operations occur at altitudes above the 3,000 foot mixing height of pollutants and training airspace covers a large area, training would not affect air quality. Ambient air pollution concentrations would not approach NAAQs nor impair visibility within any Class 1 area. The F-22 Plus-Up would not result in any long-term impacts on the regional air quality.

4.4.3 No Action

Under the No Action Alternative, aircraft operations at the base or in the airspace would not change from current F-22 training activity. Therefore, there would be no change to the current air quality.

4.5 Hazardous Materials and Waste Management

4.5.1 Base Environmental Consequences

Hazardous Materials. Existing procedures for the centralized management of the procurement, handling, storage, and issuing of hazardous materials through the HAZMART are adequate to handle the changes anticipated with the addition of six primary and one backup F-22 aircraft but would be expanded to meet the increased use. The expected approximate 16.7 percent increase in use of hazardous materials would not cause adverse impacts.

Hazardous Waste. JBER would continue to generate hazardous wastes during various operations and maintenance activities. Hazardous waste disposal procedures, including off-base disposal procedures, are adequate to handle changes in quantity and would remain the same. The base's OPlan 19-3 would be updated to reflect any changes of hazardous waste generators and waste accumulation point monitors, and there would be no adverse impacts.

The low observability coatings of the F-22 aircraft based at JBER-Elmendorf require special treatment. Existing low observability composite repair facilities at JBER-Elmendorf provide engineering and environmental controls whereby any hazardous materials associated with the

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composite materials used by the F-22 can be isolated from the air and water environments for safe disposition.

Environmental Restoration Program. Since there is no new construction or renovation of existing facilities associated with the proposed plus-up, no contaminated sites would be disturbed or affected in any way.

4.5.2 Training Airspace Environmental Consequences

No hazardous materials are discharged by F-22s in the Alaskan airspace. Various materials and fluids are contained in the aircraft but are not released in the training airspace. Potential environmental consequences of use of chaff and flares are discussed in Section 4.3.2, Airspace Safety Environmental Consequences.

4.5.3 No Action

Under the No Action Alternative, additional F-22 aircraft would not be assigned to JBER. Aircraft maintenance activities generating hazardous waste would continue to support the existing F-22 squadrons and the other aircraft stationed at JBER-Elmendorf. Chaff and flare use would continue under the training airspace.

4.6 Biological Resources

Four areas of consideration are used to identify the potential environmental consequences to wildlife and habitat. These areas are: (1) the importance (i.e., legal, commercial, recreational, ecological, or scientific) of the resource; (2) the proportion of the resource that would be affected relative to its occurrence in the region; (3) the sensitivity of the resource to proposed activities; and (4) the duration of any ecological ramifications. Impacts to resources would be considered significant if special-status species or habitats are adversely affected over relatively large areas or disturbances cause significant reductions in population size or distribution of a special-status species (40 CFR 1508.2).

4.6.1 Base Environmental Consequences

The Proposed Action requires no new construction of facilities or ground disturbance. Therefore, no impacts would occur to vegetation and no wildlife habitat would be lost within the base environs ROI at JBER-Elmendorf.

Noise contours associated with the proposed operation of the F-22s at JBER-Elmendorf are projected to be similar to current conditions (see Section 4.2 Noise). On-base species are regularly exposed to noise and human activity including F-22 operations. The additional F-22s associated with the proposed plus-up would contribute an approximately 16.7 percent increase in F-22 sorties from JBER. F-22 approaches, departures, and landing patterns for these sorties are established and defined based on patterns currently in use. These flight patterns overfly portions of the Knik Arm located to the west and north of JBER runways. The noise contours extend into the Knik Arm of Cook Inlet, where CIBW can occur. As such, CIBW could be exposed to noise associated with the F-22 overflights while at the surface or while submerged.

Appendix E, *Section 7 (Endangered Species Act) Compliance Wildlife Analysis for F-22 Plus Up Environmental Assessment*, discusses the CIBW and other wildlife species which could occur on or near JBER. .

Impacts on marine mammals are regulated under the MMPA. The MMPA prohibits the unauthorized take or harassment of marine mammals. In the context of military aircraft noise examined here, the MMPA defines harassment as “any act that injures or has the significant potential to injure a marine mammal or marine mammal stock in the wild [Level A harassment]”, or “any act that disturbs or is likely to disturb a marine mammal or marine mammal stock in the wild by causing disruption of natural behavioral patterns, including, but not limited to, migration, surfacing, nursing, breeding, feeding, or sheltering, to a point where such behavioral patterns are abandoned or significantly altered” (16 USC 1362(18)). In addition, the ESA also prohibits the unpermitted take of listed species, thereby providing additional legal protection to the CIBW. The ESA’s definition of take includes actions that would harass, harm, or kill a listed species.

Potential effects to CIBW include behavioral response to the overflight of F-22s. Animals may react to the sound of the jet aircraft or the visual stimulus of the aircraft being overhead by avoiding the area or altering their natural behavior patterns, which could constitute behavioral harassment. Exposure to the F-22 aircraft noise would be brief (seconds) as an aircraft passes overhead. The F-22’s closest approach to the water surface ranges from 653 to 4,295 feet MSL, depending on the flight procedure being conducted. Because of the F-22’s altitude and small size, as well as the rapidity of its overflight, adverse visual behavioral reactions by beluga whales in the Knik Arm cannot be predicted.

A noise impact assessment for potential behavior effects of CIBW associated with the proposed increase in F-22 aircraft operations at JBER-Elmendorf is presented in Appendix E. This Appendix demonstrates that approximately 0.04 CIBW individuals per year (four individuals in 100 years) would be behaviorally harassed annually from proposed additional F-22 flying operations. The National Marine Fisheries Service determined that this level of behavior response would mean that the F-22 plus-up may affect but is unlikely to adversely affect the CIBW (NMFS 2011; see Appendix C). Additionally, the USFWS has indicated that there are no federally listed or proposed species and/or designated or proposed critical habitat for which the USFWS is responsible within the action area of the project (USFWS 2011; see Appendix C). No further action is required regarding the ESA. The plus-up of F-22 aircraft would not be expected to have a significant effect upon the CIBW or any federally listed or proposed species and/or designated or proposed critical habitat.

4.6.2 Training Airspace Environmental Consequences

There would be no construction or ground-disturbing activities and no consequences associated with the training airspace for the Proposed Action. Therefore, no impacts would occur to vegetation and no wildlife habitat would be impacted under the training airspace.

No changes to the existing training airspace would occur under the Proposed Action. The additional F-22s would use the training airspace associated with JBER in a manner similar to the F-22s currently based there. By completion of the plus-up, the JBER F-22 operational wing

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would fly approximately 5,210 sorties per year from JBER-Elmendorf, an increase of approximately 16.7 percent. The additional F-22s would employ supersonic flight as do the existing F-22s. The augmented F-22 squadrons would continue to fly approximately 25 percent of the time spent in approved MOAs and ATCAAs at supersonic speed. F-22 training would result in an increased number of sonic booms per month under specific MOAs. Section 4.2 Noise provides details on aircraft noise associated with the proposed plus-up.

Moose, caribou, and Dall's sheep are important game species in Alaska, and critical calving grounds are located under the training airspace. Current flight restrictions over calving/lambing grounds (Air Force 1995) restrict flights to above 5,000 feet AGL during the lambing season. The F-22 does not fly below 500 feet and is above 5,000 feet 98 percent of the training time. Given the current flight restrictions over calving/lambing grounds (Air Force 1995) and the relatively unchanged noise levels associated with the proposed F-22 training, noise associated with the Proposed Action at JBER-Elmendorf would have similar impacts on wildlife as exist under baseline conditions. Some animals may startle in response to a sonic boom. However, most animals under the training airspace have been previously exposed to sonic booms from F-22 and other training aircraft and are likely habituated to the sound.

Use of training chaff and flares is expected to continue with the additional F-22 aircraft training in the airspace. Chaff and flare use would continue to be used in approved training airspace and is projected to be used in the same manner as under current conditions. The augmented F-22 squadrons would use an additional 2,855 chaff bundles and 3,791 flares annually. There would be no change in the minimum altitude or seasonal restrictions on flare release. The potential environmental consequences and characteristics of chaff and flares are consequences of: (1) ingestion of chaff fibers or chaff or flare plastic, nylon, or paper materials; (2) inhalation of chaff fibers; (3) physical external effects from chaff fibers, such as skin irritation, (4) effects on water quality and forage quality; (5) increased fire potential; and (6) potential for being struck by medium hailstone-sized flare debris.

There is no recorded incident of chaff or flare plastic, duct tape-type covering, or paper residual materials being ingested. A study of packrat (notable collectors) nests in arid areas where chaff and flares had been deployed for decades uncovered no residual chaff or flare materials (Air Force 1997). Chaff fibers rapidly break down to silica and aluminum particles chemically indistinguishable from normal dust particles. No effects from inhalation, ingestion, or skin irritation would occur. Flare altitude and seasonal restrictions in Alaska result in little if any potential for any flare-caused fire. There is very little potential of an animal being struck by a medium hailstone-sized plastic S&I flare piece from F-22 training which produces an average estimate of one piece per 1,500 acres per year (See also Appendices A, B, and F).

Chaff and flares are regularly used in approved Alaskan SUA. Therefore, no impacts to biological resources would be expected with the continued use of training chaff and defensive flares in the Alaska training airspace.

4.6.3 No Action Alternative

Under the No Action Alternative, no additional F-22 aircraft would be assigned to JBER and no additional F-22 flight activities would occur near the base or in training airspace. Airspace

training would remain the same as under current conditions. The existing F-22 aircraft would continue to train in the airspace at subsonic and supersonic speeds and use chaff and defensive flares. Biological resources would not change from existing conditions.

4.7 Cultural Resources

A number of federal regulations and guidelines have been established for the management of cultural resources. Section 106 of the NHPA, as amended, requires federal agencies to take into account the effects of their undertakings on historic properties. Historic properties are cultural resources that are listed in, or eligible for listing in, the NRHP. Eligibility evaluation is the process by which resources are assessed relative to NRHP significance criteria for scientific or historic research, for the general public, and for traditional cultural groups. Under federal law, impacts to cultural resources may be considered adverse if the resources have been determined eligible for listing in the NRHP or have been identified as important to Alaska Natives as outlined in the *American Indian Religious Freedom Act* and EO 13007, *Indian Sacred Sites*. DoD Alaska Native Policy (1999) provides guidance for working with federally-recognized Alaska Native governments. DoD policy requires that installations provide timely notice to, and consult with, tribal governments prior to taking any actions that may have the potential to significantly affect protected Alaska Native resources, rights, or lands.

Analysis of potential impacts to cultural resources considers direct impacts that may occur by physically altering, damaging, or destroying all or part of a resource; altering characteristics of the surrounding environment that contribute to the resource's significance; introducing visual or audible elements that are out of character with the property or alter its setting; or neglecting the resource to the extent that it deteriorates or is destroyed. Direct impacts can be assessed by identifying the types and locations of proposed activity and determining the exact location of cultural resources that could be affected. Indirect impacts occur later in time or farther from the Proposed Action. Indirect impacts to cultural resources generally result from the effects of project-induced population increases, such as the need to develop new housing areas, utility services, and other support functions to accommodate population growth.

4.7.1 Base Environmental Consequences

No new construction would be necessary to accommodate the proposed additional six primary and one backup F-22 aircraft. Thus, no direct impacts to cultural resources are anticipated. Impacts to historic buildings are not expected to result from the small increase in noise associated with the plus-up since their NRHP eligibility is based, in part, on their association with an active Air Force installation at which jet aircraft routinely operate, resulting in an elevated noise environment. The Proposed Action involves adding 103 Air Force personnel to support the additional six F-22 primary aircraft. This represents less than one percent of JBER population and is not expected to result in any indirect impacts to cultural resources.

4.7.2 Training Airspace Environmental Consequences

Table 2.2-3 in Chapter 2.0 describes the existing and projected MOA and ATCAA usage associated with baseline F-22 and the proposed increase of six primary aircraft. F-22 training in the MOAs would be similar to the existing use by F-22 aircraft. A summary of federal

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regulations and guidelines established for the management of cultural resources is presented in Section 2.6.

No impacts to historic properties under the airspace are expected as a result of the proposed F-22 plus-up. The additional six F-22 primary aircraft would conduct similar missions and training programs to those conducted by the existing 36 F-22s currently located at JBER-Elmendorf. The increase in plastic, paper, or duct-tape type wrapping material pieces associated with F-22 flare or chaff use is not projected to impact historic properties. All F-22 activities would take place in the same airspace currently used by the base. The modest increase in use of air-to-ground munitions on approved Army ranges is not expected to impact historic properties.

4.7.2.1 Traditional Cultural Properties and Alaska Native Concerns

A number of Alaska Native villages and traditional subsistence areas underlie Alaskan SUA (see Figure 3.7-2). The figure also includes the boundaries of the private Native Alaska regional corporations. This EA analysis considers the Alaska Native villages and their local economies based primarily on subsistence hunting and resource extraction for marketable products. Although no comments were received on the proposed plus-up, historically Alaska Natives have expressed concern that existing and projected noise levels and sonic booms could affect game in traditional hunting areas and potentially impact the local economy dependent on these resources (Air Force 2006). No traditional cultural properties have been specifically identified underneath the airspace. However, this does not mean that none are present.

The annual average noise levels under the MOAs are not expected to noticeably change as a result of increased F-22 training. As described in Section 4.2.2, the change in L_{dnmr} between baseline conditions and the Proposed Action would be 1 dB or less (Table 4.2-3). Changes in instantaneous noise levels of less than 3 dB are typically not noticeable in non-laboratory conditions. Under the Proposed Action, noise levels beneath all training airspace units except Eielson and Viper MOAs would be below 55 dB L_{dnmr} , the USEPA-identified threshold below which impacts to human health and welfare are not expected to occur (USEPA 1974). Noise levels beneath Eielson and Viper MOAs would increase by 1 dB to 59 and 57 dB L_{dnmr} , respectively.

The number of supersonic events is expected to increase as a result of the increased number of F-22s training at supersonic speeds. As noted in Section 4.2.2, these additional one to three booms per month could annoy residents or users of resources under the MOAs. This change could be discernible to Alaska Natives or others residing under or using the land under the airspace for an extended period of time. As noted in Section 4.6.2, game and other subsistence species have previously experienced sonic booms and are likely habituated to them. The increased number of sonic booms as a result of additional F-22 training is not expected to significantly affect cultural resources or Alaska Native activities. In the unlikely event of any damage claims, the Air Force has established procedures that begin with contacting the JBER Public Affairs Office. Air Force airspace managers currently identify and mitigate, where possible, use of specific airspaces during hunting seasons, especially during Major Flying Exercises, to avoid significant impacts to Alaska Native resources. This practice would continue for the proposed F-22 plus-up. No significant impacts to traditional cultural properties or Alaska Native activities are anticipated to result from the proposed F-22 plus-up.

4.7.3 No Action

Under the No Action Alternative, existing military flight training would continue, and cultural resources would continue to be managed in compliance with federal law and Air Force regulations.

4.8 Land Use, Transportation, and Recreation

Land uses are established on JBER and on the periphery of JBER. The Municipality of Anchorage is south and west of the base, waters of the Knik Arm of the Cook Inlet are located west and north of the base and private and state lands are to the east and south east. In most areas, off-base land use is not affected by activities at JBER. As described in Chapter 2.0, the key elements of the proposal are flight activities and personnel changes. Established and recognized noise models have been applied to estimate the off-base and on-base noise conditions. These models are described in Appendix D. For the land use and transportation resources, consequences are associated with increases in noise due to an increase in sorties. Potential effects to land use plans, land use patterns and circulation due to personnel increases are considered.

4.8.1 Base Environmental Consequences

Under the Proposed Action, the total geographic area exposed to 65 dB L_{dn} or more is presented on Figure 4.2-2 and quantified in Table 4.2-1. The off-base area consists of an additional 6.6 acres over the Port of Anchorage, 410.7 acres over water of the Knik Arm, and 0.2 acre of land west of the Knik Arm. Some areas on base would also experience higher noise levels. These changes in the noise environment would not result in changes to land management, land use, or land ownership, nor would there be any changes to the safety zones.

The DoD and FAA adopted the concept of land use compatibility as an accepted measure of aircraft noise effect. USEPA has reaffirmed these concepts (see Appendix D). The FAA has guidelines that establish the best means for determining noise impact in airport communities. Industrial land uses, such as ports, are compatible within the 65 dB L_{dn} noise contours.

The JBER-Elmendorf noise abatement program precludes flight operations between 10 p.m. and 7 a.m., except for national emergency or infrequent large scale exercises. This program reduces the potential for noise impacts upon land uses and helps define the 65 dB L_{dn} contours. Although the additional F-22 operations would produce an increase in noise exposure within the base boundaries and over compatible land uses, that increase should not result in changes to land use or land ownership.

A less than one percent increase in on-base employment is likely to slightly increase vehicle trips in the long term. The negligible increase in traffic is not likely to substantially affect commute times.

Recreational activities on JBER are extensive and seasonally variable. On-base recreation reflects the off-base recreation available to residents of Anchorage and neighboring

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communities. The plus-up of six F-22 aircraft with the corresponding increase in base employment would not impact base or off-base recreational opportunities.

4.8.2 Training Airspace Environmental Consequences

F-22 training in Alaska airspace with the proposed increase of six primary aircraft would be similar to the existing use by F-22 aircraft. An approximate 16.7 percent increase in sortie-operations is anticipated under the Proposed Action. There would be no reason to believe that such an increase of F-22 training would affect land use or recreation beneath the training airspace. The potential to affect land use or recreation under the airspace is slight.

Under the Proposed Action, subsonic noise would increase slightly over baseline conditions (refer to Section 4.2.2). Most annual average noise levels are expected to remain below 45 dB L_{dn} . Where noise levels are higher than 45 dB L_{dn} , they are expected to increase by 1 dB or less (Table 4.2-3) under the Proposed Action over existing conditions. The USEPA has identified an annual average noise level of 55 dB L_{dn} as a level to begin assessing the potential for noise impacts. Under the Proposed Action, noise levels beneath all training airspace units except Eielson and Viper MOAs would be below 55 dB L_{dn} . Noise levels beneath Eielson and Viper MOAs would increase by 1 dB to 59 dB L_{dn} and 57 dB L_{dn} , respectively. Noise level changes of 1 dB are effectively indiscernible. With noise levels below 55 dB L_{dn} , or minimally changed throughout, there would be no anticipated effect on land use patterns, ownership, or management practices under military training airspace.

Under the center of Stony A/B MOAs, Section 4.2.2 shows that the number of sonic booms would increase from 18.1 sonic booms per month (one boom per 1.7 days) to 21.5 sonic booms per month (one boom per 1.4 days). Under the Naknek MOAs, the number of sonic booms would increase from an average of 1.5 per month (one boom per 20 days) to an average of 1.7 per month (one boom per 17 days) (see Table 4.2-2). Residents or long-term visitors could experience more sonic booms as a result of the increase in supersonic activities. The increase in supersonic activity could be perceived in isolated areas as an unwanted intrusion, and persons could be annoyed. The increased number of sonic booms would not be expected to impact management goals for special use areas under the MOAs.

Detected sonic booms have the potential to cause increased disturbance in recreational, hunting, or fishing areas. Under most airspaces, it is unlikely that any occasional visitor or hunter would discern the difference between the current number of sonic booms and the increased number associated with an F-22 plus-up. Individuals who spend extensive time subsistence hunting and fishing under some MOAs could discern an increase. The increased frequency of sonic booms would not be expected to affect land use or land use patterns, ownership, or management, but the increase could result in personal annoyance.

A number of Alaska Native villages and traditional subsistence areas underlie Alaskan SUA. Alaska Natives have expressed concern that existing and projected noise levels and sonic booms could affect recreational uses, as well as traditional hunting activity. In addition to being important social and cultural activities, the local economy is often dependent on subsistence activities. As noted above, average noise level increases under the MOAs are not expected to be

discernable, and a detectible increase in sonic booms could result in annoyance, but would not be expected to affect land used for subsistence activities.

4.8.3 No Action

Under the No Action Alternative the Air Force would continue to fly F-22 aircraft at JBER-Elmendorf and train in existing Alaska SUA. As with the proposed action, no consequences associated with aircraft overflights and aircraft noise to special land use or recreational areas would be anticipated.

4.9 Socioeconomics

The F-22 plus-up would require personnel to operate and maintain the additional six primary aircraft and provide necessary support services.

4.9.1 Base Environmental Consequences

Existing population and employment characteristics in Anchorage were analyzed to assess the potential socioeconomic impacts of the proposed beddown, as presented in Section 3.9.2. The Proposed Action involves adding 103 Air Force personnel to support the additional six F-22 primary aircraft. This represents less than one percent of JBER employment. The addition of any personnel is a positive element to the regional economy although the relative change in JBER employment would not discernibly affect the regional economy.

Socioeconomic impacts would occur if changes associated with the plus-up substantially affected demand for housing or community services, such as schools, or substantially affected economic stability in the region. The potential population, employment, income, and output associated with an addition of less than one percent of base personnel and no new construction would have no measurable effect upon services, schools, or the regional economy.

The Air Force makes on-base housing available for military personnel. No additional on-base housing would be available for the increase of 103 personnel and their dependents. The Anchorage housing market with approximately 6,700 vacant units and a 6.0 percent vacancy rate would be expected to easily absorb the additional 103 personnel.

4.9.2 Training Airspace Environmental Consequences

A number of Alaska Native villages and traditional subsistence areas underlie Alaskan SUA. The local economy in many of these villages is stimulated by subsistence activities. The proposed increase in training operations from six additional F-22 aircraft would increase the number of F-22 overflights, although the total fighter activity would have somewhat fewer overflights as occurred prior to the relocation of the F-15C aircraft in 2010. The additional F-22 training would not be expected to discernibly affect annual average noise levels under the training airspace.

The single exception is in the area of sonic booms. Training F-22 aircraft fly at supersonic speed an estimated 25 to 30 percent of its training mission. Although the F-22 flies at high altitude and

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thus the energy from sonic booms is likely to dissipate, a detectible increase in sonic booms would be anticipated as presented in Table 3.2-4. This increase could be noticeable to individuals spending extended time under the airspace. The nature of sonic booms is such that they can be heard, often as a rolling thunder sound, in areas on the edge of the airspace boundaries. Sonic booms, or the increase in sonic booms, are not expected to significantly affect subsistence, recreational hunting or fishing, on the local economy. However, sonic booms could be viewed as unwelcome intrusions to activities in remote areas. For any damage claims associated with sonic booms, the Air Force has established procedures that begin with contacting the JBER Public Affairs Office.

The economy of Alaska Native villages and traditional subsistence areas that underlie Alaskan SUA is often based on subsistence activities. Some Alaska Natives have historically expressed concerns that sonic booms could affect game in traditional hunting areas or military flights could affect the use of private aircraft to access hunting or fishing locations.

The change in sonic booms may be discernible to Alaska Natives or others residing under or using the land under the airspace for an extended period of time. Increases in sonic booms would not be expected to substantially affect subsistence or guided hunting or fishing. JBER airspace management has an established scheduling of airspace use particularly during Major Flying Exercises to avoid, to the extent possible, training in airspace over areas at the beginning of hunting season. This reduces potential conflicts with subsistence and recreational hunting activities.

The F-22 improves pilot awareness of other aircraft, and the F-22 flight profiles are primarily at high altitudes. The F-22 training aircraft would not be expected to impact general air aviation throughout the airspace. The local economy dependent on traditional resources and on private aircraft would not be expected to be impacted by the proposed six additional primary F-22 aircraft.

4.9.3 No Action

Under the No Action Alternative, no beddown of the additional F-22 aircraft would occur at JBER at this time. The personnel changes would not take place, and no socioeconomic effects associated with the F-22 plus-up would occur. No changes in flight activity, facilities, or personnel are anticipated. Annual average noise levels and supersonic training events would continue as at present.

4.10 Environmental Justice

The objectives of EO 12898 include identification of disproportionately high and adverse health and environmental effects on minority and low-income populations that could be caused by a federal action.

4.10.1 Base Environmental Consequences

Disadvantaged groups within the general vicinity of JBER, specifically the community of Mountain View, include minority, low-income and youth populations, which represent a

disproportionate segment of the population. The F-22 and C-17 flight operations explained in Section 2.1.1 have specific main and cross-wind runway flight operations which insure that 65 dB L_{dn} noise contours do not extend into the community of Mountain View.

The flight activity and personnel changes associated with the Proposed Action options are not expected to create significant adverse environmental or health effects on base. No impact would be anticipated to disadvantaged populations. There would be no health or safety effects upon children.

4.10.2 Training Airspace Environmental Consequences

Alaska Natives are primary users of the natural resources under the training airspace. For many residents, subsistence fishing and hunting contribute substantially to people's diets and provide much-needed supplementary income. Individuals from these groups have expressed concerns related to aircraft noise impacts on their villages and on subsistence hunting under the airspace. Under the Proposed Action, subsonic noise levels within the MOAs would be approximately the same or slightly more than currently occurs under the airspace. Additional F-22 training would increase the number of sonic booms under training MOAs. Alaska Natives regularly hunting or fishing under these airspaces could detect an increase in sonic booms that could annoy some individuals who discerned the change.

The random nature and intensity of sonic booms throughout the area under an airspace make it impossible to avoid a specific community. Sonic boom intensity can vary from the rolling sound of distant thunder to a sharp double crack. Although the number of sonic events would be expected to increase under specific MOAs, the booms would not be expected to disproportionately affect communities. The increase of one to three sonic booms per month would not be expected to have a health or safety effect upon children.

The JBER airspace managers seek to take into consideration the hunting season while scheduling airspace use for training. Continued attention to airspace scheduling, hunting season, and Alaska Native concerns in airspace management, especially during a Major Flying Exercise, reduces the potential for environmental consequences from aircraft training operations.

The large rural Alaska Native population distributed throughout the state of Alaska, as well as under the existing airspace, results in no disproportionate impacts expected to occur to any area of minority populations.

4.10.3 No Action

Under the No Action alternative, no changes in flight activity, noise contours, facilities, or personnel are anticipated. No impacts to disadvantaged or youth populations would occur. Supersonic training by F-22 and other aircraft would continue within the airspaces.

5.0 CUMULATIVE IMPACTS

5.1 Cumulative Effects Analysis

The CEQ regulations stipulate that the cumulative effects analysis in an EA considers the potential environmental consequences resulting from “the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions” (40 CFR 1508.7). Chapter 3.0 discusses the baseline conditions for environmental resources at JBER and in the F-22 training airspace. Chapter 4.0 discusses potential consequences at the base and under the training airspace associated with the F-22 plus-up. Chapter 5.0 identifies past, present, and reasonably foreseeable projects that could cumulatively affect environmental resources in conjunction with the F-22 plus-up at JBER-Elmendorf and use of Alaskan military training airspace.

Assessing cumulative effects begins with defining the scope of other project actions and their potential interrelationship with the Proposed Action (CEQ 1997). The scope must consider other projects that coincide with the location and timetable of the Proposed Action and other actions. Cumulative effects analyses evaluate the interactions of multiple actions.

The CEQ (1997) identified and defined eight ways in which effects can accumulate: time crowding; time lag; space crowding; cross boundary; fragmentation; compounding effects; indirect effects; and triggers and thresholds. Furthermore, cumulative effects can arise from single or multiple actions, and through additive or interactive processes (CEQ 1997).

Actions not part of the proposal, but that could be considered as actions connected in time or space (40 CFR 1508.25) (CEQ 1997) may include projects that affect areas on or near JBER and projects underlying the affected training airspace. This EA analysis addresses three questions to identify cumulative effects:

1. Does a relationship exist such that elements of the project alternatives might interact with elements of past, present, or reasonably foreseeable actions?
2. If one or more of the elements of the alternatives and another action could be expected to interact, would the alternative affect or be affected by impacts of the other action?
3. If such a relationship exists, does an assessment reveal any potentially significant impacts not identified when the alternative is considered alone?

An effort has been made to identify major actions that have occurred, are being implemented, or are in the planning phase at this time. To the extent that details regarding such actions exist and the actions have a potential to interact with the proposal, these actions are included in this cumulative analysis. This approach enables decision-makers to have the most current information available so that they can evaluate the environmental consequences of the Proposed Action.

5.1.1 *Past, Present, and Reasonably Foreseeable Actions*

This EA provides decision-makers with the cumulative effects of the Proposed Action as well as the incremental contribution of past, present, and reasonably foreseeable actions. Recent past

and ongoing military action in the region were considered as part of the baseline or existing condition in Chapter 3.

5.1.1.1 *Elmendorf AFB, Fort Richardson, Other Military Actions, and the Establishment of JBER*

Elmendorf AFB and Fort Richardson, separately and jointly, were active military installations that experienced continuous and rapid evolution of mission and training requirements. This process of change is consistent with the U.S. defense policy that the United States Military Forces must be ready to respond to threats to American interest throughout the world. The two bases were combined into JBER in 2010 and will continue to experience changes in mission and training requirements.

The combined base, like other major military installations, regularly requires new construction, facility improvements, and infrastructure upgrades. In addition, Table 5.1-1 lists past, present, and potential future major military projects occurring in the region. Each project was reviewed to consider the implication of each action and its synergy with the proposed F-22 plus-up. Of particular interest were potential overlap in affected area and project timing. The projects listed on Table 5.1-1 have the potential to interact in time or location with the proposed F-22 plus-up.

The relocation of three F-15 aircraft squadrons, the beddown of C-17 aircraft, BRAC decisions regarding C-130 aircraft, proposed transportation projects, and other regional projects were cumulatively evaluated. As JBER combines administrative, air, and ground activities over the next few years, there could be a desire to assess such combined efforts in a future environmental analysis. Such a future analysis, should it occur, would address all JBER activities. No significant environmental consequences would cumulatively result from preparation of an undefined separate environmental analysis not directly related or connected with the F-22 plus-up EA.

5.1.1.2 *Non-Federal Actions*

Non-federal actions include major public and private projects within the ROI. The Municipality of Anchorage is a large urban area with multiple construction projects occurring, especially in the summer months. Specific major actions within the vicinity of JBER are summarized in Table 5.1-2. The projects listed on Table 5.1-2 have the potential to interact in time or location with the proposed F-22 plus-up.

5.1.2 *Cumulative Effects Analysis*

5.1.2.1 *Airspace Management and Air Traffic Control*

This EA addresses the JBER cumulative airspace effects by incorporating all existing and plus-up F-22s, C-17s, C-130s, helicopters, and other aircraft at JBER along with the outgoing F-15s. The net effect is an estimated overall reduction in JBER flight operations by jet fighters over the past five years. The change in flight operations does not substantially change JBER tower responsibility. These actions do not substantially affect the AATA management of Anchorage airspace.

Table 5.1-1. Past, Present, and Reasonably Foreseeable Military Projects (Page 1 of 2)

<i>Action</i>	<i>Document</i>	<i>Description</i>
C-17 Beddown	Elmendorf AFB EA 2004 (Air Force 2004)	The C-17 aircraft brought the Air Force Alaska airlift capabilities to state-of-the-art standards and increased its capacity. Routine aircraft operations (both mission- and training-related), and the construction and use of support facilities were part of the C-17 beddown. Joint training with Army forces as well as low-level training are part of C-17 operations.
Transformation of US Army Alaska	U.S. Army EIS 2004 (U.S. Army 2004)	This action included accommodation for 4,000 more soldiers relocating from installations worldwide, as well as activation of a new airborne brigade. The action transformed the 172 nd Infantry Brigade into a Stryker Brigade Combat Team. This included changes to force structure and modification of ranges, facilities, and infrastructure designed to meet the objectives of Army transformation in Alaska. Locations for changes in force structure and stationing include Fort Wainwright and Fort Richardson. Activity changes occurred within the Fort Wainwright cantonment area, Tanana Flats Training Area, Yukon Training Area, and Donnelly Training Area.
C-17 Beddown	Elmendorf AFB EA 2004 (Air Force 2004c)	C-17 operations in Alaskan SUA include upgrading Runway 06/24 at JBER-Elmendorf, use of the runway as a C-17 assault landing zone, and frequent use of five existing drop zones for C-17 training.
Modification of MTR	Elmendorf AFB EA 2007 (Air Force 2007c)	The Air Force modified existing MTRs within the State of Alaska to better connect the MTRs with existing special use airspace. These changed MTRs are used by aircraft with low level navigation missions. The F-22 does not use MTRs for training.
F-22 Beddown Replacing F-15s	Elmendorf AFB EA 2006 (Air Force 2006)	Two F-22 squadrons with a total of 36 primary aircraft replaced two (later three) F-15C and F-15E squadrons (total of 60 aircraft) at Elmendorf AFB. Facilities were constructed and/or remodeled for the beddown of the two F-22 squadrons. Beddown included operations from Elmendorf AFB and training in existing Alaska airspace where the F-15s had trained.
Eielson Aggressor Squadron	Eielson AFB EA 2007 (Eielson 2007)	This project established an F-16 Aggressor Squadron at Eielson AFB. The Aggressors support training of F-22 pilots and other military personnel as well as supporting Large Force Exercises and Major Flying Exercises in existing Alaska airspace. The F-16s are fourth generation fighter aircraft.
Establishing Delta MOA	Elmendorf AFB EA 2010 (Air Force 2010b)	The Delta MOA connects the Fox and Yukon MOA complexes during Major Flying Exercises not to exceed 60 days per year with advance scheduled hours of use and avoidance of specified recreation and other times. Use of the Delta MOA substantially enhances realism for training.
Kulis ANG Relocation	Alaska National Guard EA 2007 (Air Force 2007b)	This project relocated the 176 th Air National Guard Wing with up to 12 C-130H, 3 HC-130N, and 5 HH-60 aircraft and expeditionary combat support from Kulis AGS to Elmendorf AFB. Relocating Air National Guard C-130s replaced the C-130 aircraft moved from Elmendorf during the C-17 beddown.

Table 5.1-1. Past, Present, and Reasonably Foreseeable Military Projects (Page 2 of 2)

<i>Action</i>	<i>Document</i>	<i>Description</i>
Fort Richardson/ Elmendorf AFB Joint Basing	BRAC 2005 Joint Basing Road Map Study 2010	The Joint Basing Implementation Roadmap Study called for three pilot studies investigating more efficient use of installations that are adjacent to one another but managed by different services (e.g. Army/ Air Force, Navy/ Air Force). Elmendorf and Fort Richardson implemented the Joint Basing Concept in 2010. Activities include combined organizations and shared community service facilities.
Station and Train a New Aviation Unit in Alaska	U.S. Army EIS 2010 (U.S. Army 2010)	The proposed expansion of U.S. Army Alaska's aviation assets and capabilities would support both integrated training and deployment abroad and would continue the process of Army transformation in Alaska. Aviation units would include various helicopter types and additional soldiers distributed between JBER and Fort Wainwright. The aviation unit would enhance integrated training to achieve proficiency in the execution of combined-arms, joint, and coalition operations under realistic training.
Reassignment of F- 15C fighter aircraft squadron		The last squadron of 27 F-15C aircraft was reassigned from JBER in 2010.
Resumption of Year-Round Firing Opportunities	U.S. Army Fort Richardson Final EIS in process 2010 (U.S. Army 2010)	The Proposed Action would restore year-round live-fire training capabilities at Fort Richardson, AK, in order to allow active units to achieve and maintain combat readiness, reduce deployment hardships on Soldiers and their Families, and reduce annual expenditures associated with travel to distant facilities to conduct training. The EIS evaluates No Action Alternative (use of Eagle River Flats Impact Area under a winter only firing regimen), year-round use of Eagle River Flats Impact Area (USARAK's preferred alternative), and development of a new impact area on Fort Richardson.
Military Housing Privatization, Joint Base Elmendorf- Richardson	JBER EA 2011	The Air Force proposes to transfer responsibility for housing and support facilities to a private developer. Over the ten-year initial development period, the private developer would renovate 272 units, demolish 584 units, and construct 582 units. As a result of these actions, JBER-Richardson would have a family housing inventory of 1,240 units.
JPARC	ALCOM studies underway 2011	The Alaska Joint Command proposes a series of airspace and range actions to enhance individual unit and Joint training in response to technological changes, lessons learned, and anticipated threats over the next 20 years. These enhancements propose extending and establishing MOAs and Restricted Airspace.
Cherry Hill Gravel Site	Elmendorf AFB EA 2005	The Cherry Hill Borrow Site is located on Elmendorf AFB. Anticipated work at Cherry Hill is expected from 2006 through 2010. The FONSI/FONPA was signed by the PACAF/CE on 1 March 2006.

Table 5.1-2. Past, Present, and Reasonably Foreseeable Civil Projects

<i>Action</i>	<i>Document</i>	<i>Description</i>
Port of Anchorage Expansion	Marine Terminal Redevelopment EA 2005	The Port of Anchorage is located in close proximity to JBER. There are stages to the expansion project that are expected to span from 2006 to 2013. The construction in the area is expected to increase through all three phases of the project.
Port of Anchorage Development	U.S. Department of Transportation EA 2005	The Marine Terminal Redevelopment port expansion project will rebuild and enlarge docking facilities, improve loading/unloading facilities, provide additional working space to handle shipped fuel, freight and other materials, and improve access by road and rail transportation serving the port. Enlarged docking facilities could be used by cruise ships.
Port MacKenzie Development	Mat Su Borough NMFS identified cumulative impacts, 2006	Port MacKenzie development in the Matanuska-Susitna (Mat Su) Borough is proposed to provide an additional transportation connection to Anchorage and would include associated railroad connections, highway connections, and Cook Inlet Ferry system.
Knik Arm Crossing Project	The Federal Highway Administration (FHWA) Final EIS 2007 (FHWA 2007)	Proposal to construct access between the Municipality of Anchorage and the Mat Su Borough with a bridge crossing of Knik Arm, including connections to the roadway network. The proposed access routes cross portions of JBER.
Cook Inlet Oil and Gas Exploration	Conoco Phillips and Union Oil Company NMES 2007 permit	Conducted seismic investigations offshore Cook Inlet to evaluate subsurface geology for potential oil and gas deposits.
Cook Inlet Tidal Energy Project	Federal Energy Regulatory Commission feasibility studies ongoing	Evaluation of potential energy generation through use of Cook Inlet tidal flows. Of two locations, the NMFS recommended to not use the location adjacent to Cairn Point in Knik Arm to reduce the potential for marine mammal impacts.
Natural Gas Pipeline	Federal and state agency ongoing discussion	Alaska is pursuing the construction of a natural gas pipeline. This possible project is still in the early stages and has not yet received approval. Part of the construction staging and possibly a pipeline extension could occur in the Anchorage area.

The cumulative effect of the plus-up would not be expected to change airspace management within the Alaskan training airspace. The airspace analysis in this EA includes all expected aircraft operations in existing Alaska military training airspace and ranges. Potential airspace enhancements to the Joint Pacific-Alaskan Range Complex (JPARC) are currently under study. Any potential JPARC impacts to airspace management or to other environmental resources will be addressed in separate environmental documentation.

Replacing three squadrons operating a total of 60 primary twin-engine F-15C and F-15E fighter aircraft with 42 (36 plus the proposed 6) similarly-sized primary twin-engine F-22 fighter aircraft would not be expected to have any adverse cumulative effect in conjunction with other past, present, or reasonably foreseeable actions.

5.1.2.2 Noise

JBER-Elmendorf noise conditions addressed for the F-22 plus-up in Section 4.2 take into consideration the F-22 beddown, C-17 beddown, Kulis C-130 relocation, and F-15 changes. The noise analysis for the F-22 presented in Section 4.2 is effectively a cumulative analysis (see Figure 4.2-1). The cumulative noise effects are those identified in Section 4.2. Noise effects under the airspace also reflect implementation of the cumulative actions from changes in F-15, F-22, C-130, C-17, and training exercises.

Noise under the training airspace also represents cumulative activity from aircraft beddowns and reductions at JBER-Elmendorf. There would be no substantial cumulative effect to airspace noise from the F-22 plus-up in conjunction with past, present, or reasonably foreseeable projects.

5.1.2.3 Safety

Flight, ground, and explosives safety associated with the F-22 plus-up are not expected to have any cumulative effects in conjunction with other past, present, and reasonably foreseeable actions. None of these cumulative actions except the potential bridge access routes could affect safety on the base or in base environs. The Air Force is working with the Knik Arm Bridge and Toll Authority to protect base safety and security.

5.1.2.4 Air Quality

No new construction projects are scheduled in conjunction with the F-22 plus-up. Operational emissions would increase as aircraft and personnel are added to the base, but cumulative emissions, which include the departure of the F-15s, would result in lower overall JBER-Elmendorf base-generated total emissions.

Implementation of other cumulative projects would add to the total air emissions in the region. The Knik Arm Crossing has the potential for growth with associated increases in regional vehicle emissions as it would open the way for further development in areas that are currently undeveloped. Further development and other civilian and military projects could contribute to a net increase in overall emissions.

5.0 Cumulative Impacts

The C-17 beddown and initial F-22 beddown resulted in temporary increases in construction emissions. The construction occurred in a phased approach, and emissions were spread over time. The transformation of U.S. Army Alaska increased personnel on what is now JBER by 4,000 soldiers. This population increase results in an accompanying increase of payroll, secondary employment, and vehicular air emissions. The JPARC modification of MOAs could result in an increase in low-altitude emissions from Aggressor aircraft, although altitude and dispersion should result in no airspace cumulative impacts.

JBER is in attainment for all of the criteria pollutants regulated by the CAA. The installation is located adjacent to Anchorage, which has CO air quality issues during winter months, and Eagle River, which is in attainment status for all criteria pollutants except PM₁₀. The majority of the PM₁₀ affecting Eagle River is associated with fugitive dust generated from travel on unpaved roads. Cleared areas, volcanoes, glacial silt, and forest fires are identified as other PM₁₀ sources. Approximately 10 percent of the PM₁₀ is attributable to automobile exhaust, wood-burning stoves, and industrial sources. The addition of criteria pollutants associated with the F-22 plus-up is so slight that it would not affect changes to air quality attainment status, even in combination with other local activities.

Cumulative projects would result in both direct and indirect emission of GHGs. Construction vehicles, personal vehicles, aircraft, transport trucks, buses, and military vehicles would directly produce GHGs. CO₂ resulting from vehicle engines would be the primary source of GHGs. GHG emissions are expected to be minimal and not significant. Indirect emissions of GHGs would result from fossil fuels being produced and transported to support regional projects. Quantification of such indirect effects is nearly impossible.

5.1.2.5 Hazardous Materials and Waste Management

Cumulative regional construction could result in increased construction wastes. No construction would occur with the F-22 plus-up. Separate environmental analyses address project specific hazardous materials and hazardous wastes. Best management practices for regional construction would reduce the potential cumulative impacts.

No hazardous materials would be anticipated under the airspace. Chaff and flare effects would be as described in Section 4.5.2.

5.1.2.6 Biological Resources

The primary biological resource which could be affected by cumulative projects is the CIBW. Several past, present, and planned projects result in increased noise from construction and other sources within the Knik Arm.

Cumulative direct impacts would come from regional development, including coastal zone construction and effects on intertidal and subtidal marine habitats. Indirect effects could come from human activities, including increased recreational boating and increased storm water runoff into the beluga habitat. The Knik Arm Crossing EIS identifies the main effects to CIBW to be increased commercial and residential growth in the area resulting in additional marine vessel traffic at the Port MacKenzie Dock, greater Cook Inlet Ferry use, increased vessel noise and traffic, more accidental fuel spills, increased noise from operations, and increased turbidity resulting from

re-suspension of mud substrate by propeller scour. Construction impacts on belugas could include avoidance of the construction zone, changes in resting or feeding cycles, displacement from habitat, masking of sounds and changes in vocal behavior, changes in swimming or diving behavior, altered direction of movement, and physical injury (FHWA 2007).

Resumption of year-round live-fire training at Eagle River Flats Impact Area could result in local effects on beluga whales unless mitigated by establishing training protocols that prohibit firing explosive munitions at Eagle River Flats Impact Area when beluga whales are present in Eagle River. Minor impacts would be expected on CIBW because 160 dB noise contours for the 105-mm and 120-mm weapons systems extend into Eagle Bay. Studies have shown that underwater noise can cause whales and other marine mammals to exhibit avoidance behavior which is classified as a "Class B take." Neither the 60-mm nor the 81-mm mortars would generate noise within either Eagle River or Eagle Bay at levels greater than 160 dB at frequencies within the hearing range of a beluga whale (40Hz or higher). Any impacts, even minor, could contribute to the overall cumulative effects on the beluga whale. The Knik Arm Crossing EIS indicated that cumulative impacts to the beluga whale could be substantial due to the importance of Knik Arm and Upper Cook Inlet as habitat for whales. The reasons for the decline in the beluga whale population are unknown, and increased human interaction undoubtedly plays a part.

The cumulative effect of overflight from fighter aircraft based at JBER-Elmendorf would be expected to be less than had been experienced in 2008 before the replacement of 60 F-15s by 36 plus the proposed six similarly-sized F-22 aircraft. The F-22 plus-up, with the potential for 0.04 whales per year to display avoidance behavior, is not projected to contribute significantly to the cumulative impacts upon the beluga population.

No biological adverse cumulative impacts would be expected in conjunction with the F-22 plus-up either at the base or under the training airspace.

5.1.2.7 Cultural Resources

There would be no construction associated with the F-22 plus-up. Thus, historic buildings and archaeological sites would not be impacted. Previous aircraft beddown projects resulted in on-base construction, some of which affected historic architectural resources at JBER. Consultations and adopted mitigations reduced impacts to acceptable levels.

Civil projects with potential to contribute to cumulative impacts to area cultural resources include the Knik Arm Crossing and bridge access routes. Such projects potentially impact the viewshed and traffic use patterns within the NRHP-eligible historic districts as well as result in direct impacts to archaeological resources. The State of Alaska is pursuing the construction of a natural gas pipeline that could include construction in the Anchorage area that would have the potential to impact cultural resources, contributing to area cumulative impacts.

Any federal-related projects would be subject to compliance with NEPA and Section 106 of the NHPA with the result that adverse effects would be mitigated, reducing cumulative impacts that could occur.

The F-22 plus-up would not be expected to result in incremental significant or adverse cumulative effects to NRHP-eligible buildings, archaeological sites, or traditional resources in the region in conjunction with past, present, or reasonably foreseeable projects.

5.0 Cumulative Impacts**5.1.2.8 Land Use, Transportation, and Recreation**

Base flight activity and personnel changes would be consistent with existing land use plans and would not be expected to substantially affect land use patterns or traffic circulation in the ROI. Implementation of certain foreseeable future actions however, is likely to generate land use and transportation effects in the vicinity of JBER. The Knik Arm Crossing is proposed to alter circulation by linking the Municipality of Anchorage and the Mat-Su Borough, potentially affecting development patterns in the region. In addition, proposed bridge access routes would traverse JBER. Proposed expansion at the Port of Anchorage, just west of JBER, could alter land use and land ownership patterns, and increase traffic congestion. Construction of these and other reasonably foreseeable projects could increase pressure on regional infrastructure and construction resources.

The F-22 plus-up would not be expected to result in incremental significant or adverse cumulative effects to land use, transportation, or recreation in the region in conjunction with past or reasonably foreseeable projects.

5.1.2.9 Socioeconomics

Proposed personnel changes and airspace activities associated with the proposed F-22 plus-up are not expected to generate discernible impacts to populations or economic activity in the ROI. Regional cumulative socioeconomic effects are driven by energy development and overall economic activity. Economic pursuits in the region, including those related to Alaska Native subsistence activities, are not expected to experience any major limitations or negative effects under implementation of the F-22 plus-up separately or in conjunction with relevant past, present and reasonably foreseeable future actions.

A number of military and non-military projects would increase the demand for construction employment and activity in the region. Although the increase in economic activity associated with a specific project would be temporary, lasting only for the duration of the construction period, the cumulative effects of the construction projects create employment for the foreseeable future. Net JBER increases with the transformation of U.S. Army, which involves an influx of approximately 4,000 personnel to the region, result in regional employment and population effects which are perceived as positive to the community.

Incremental effects of the F-22 plus-up, in combination with past and reasonably foreseeable future actions, would not be expected to create any significant or adverse cumulative effect to socioeconomic resources in the region.

5.1.2.10 Environmental Justice

Nearly all the cumulative projects identified in Tables 5.1-1 and 5.1-2 affect the larger population of Municipality of Anchorage in a way that does not disproportionately impact minority, low-income, or youth populations. Changes in access to areas, changes in on-base projects, and changes in airspace affect all users and/or residents under the airspace which include non-minority and minority populations. No disproportionate effects would be expected to minority or disadvantaged populations, and there would be no expected health or safety effects to children.

5.2 Other Environmental Considerations

5.2.1 *Relationship Between Short-Term Uses and Long-Term Productivity*

CEQ regulations (Section 1502.16) specify that environmental analysis must address "...the relationship between short-term uses of man's environment and the maintenance and enhancement of long-term productivity." Special attention should be given to impacts that narrow the range of beneficial uses of the environment in the long-term or pose a long-term risk to human health or safety. This section evaluates the short-term benefits of the proposal compared to the long-term productivity derived from not pursuing the proposal.

Short-term effects to the environment are generally defined as a direct consequence of a project in its immediate vicinity. Short-term effects could include localized disruptions and higher noise levels in some areas. Five additional F-22 daily sorties are proposed to be flown at JBER-Elmendorf. Off-base noise levels would increase over the Knik Arm and portions of industrial lands near the base. This would not be expected to affect local land use and would not impact the environmental long-term productivity of the region.

The military training that occurs in the airspace results in noise effects that are transitory in nature. Such noise effects would be short term and would not be expected to result in permanent or long-term changes in wildlife or habitat use. Under the F-22 proposed plus-up, these short-term changes would have a negligible long-term effect.

The F-22 proposal involving 103 more Air Force personnel and six additional primary aircraft would not significantly impact the long-term productivity of the land. Continued use of chaff and flares could be an annoyance to an individual finding and identifying residual chaff or flare materials, but would not negatively affect the long-term productivity of the region's land, air, or water.

5.2.2 *Irreversible and Irretrievable Commitment of Resources*

Irreversible and irretrievable resource commitments are related to the use of nonrenewable resources and the effects that the uses of these resources have on future generations. Irreversible effects primarily result from the use or destruction of a specific resource (e.g., energy and minerals) that cannot be replaced within a reasonable time frame. Irretrievable resource commitments involve the loss in value of an affected resource that cannot be restored as a result of the action.

For JBER, most impacts are short-term and temporary (such as air emissions from operations) or longer lasting (such as noise). Air Force aircraft and personnel would use fuel, oil, and lubricants in normal activities.

Training operations would involve irreversible consumption of nonrenewable resources, such as gasoline used in vehicles and jet fuel used in aircraft. Training would also involve commitment of chaff and flares. None of these activities would be expected to significantly decrease the availability of minerals or petroleum resources.

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Appendix A

Characteristics of Chaff

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APPENDIX A CHARACTERISTICS OF CHAFF

Chaff is currently authorized for use in the existing Alaska training airspace and, under the Proposed Action, chaff would continue to be employed in the airspace. Chaff consists of extremely small strands (or dipoles) of an aluminum-coated crystalline silica core. When released from an aircraft, chaff initially forms a momentary electronic cloud and then disperses in the air and eventually drifts to the ground. The chaff effectively reflects radar signals in various bands (depending on the length of the chaff fibers) and forms an electronic image of reflected signals on a radar screen. Immediately after deploying chaff, the aircraft is obscured from radar detection by the cloud which momentarily breaks the radar lock. The aircraft can then safely maneuver or leave an area.

Chaff is made as small and light as possible so that it will remain in the air long enough to confuse enemy radar. Each chaff fiber is approximately 25.4 microns in diameter (thinner than a human hair) and ranges in length from 0.3 to over 1 inch. The weight of chaff material in the RR-170 or RR-188 cartridge is approximately 95 grams or 3.35 ounces (United States Air Force [Air Force] 1997). Since chaff can obstruct radar, its use is coordinated with the Federal Aviation Administration (FAA). RR-170-type combat chaff has been used by F-15C and F-15E training aircraft and similar chaff is used by F-22 aircraft currently training in Alaska airspace. This chaff is the same size and the cartridge is the same size as RR-188 chaff in Figure 1. RR-188 chaff has D and E band dipoles removed to avoid interference with FAA radar. RR-170 chaff dipoles are cut to disguise the aircraft and produce a more realistic training experience in threat avoidance.

A1 Chaff Composition

Chaff is comprised of silica, aluminum, and stearic acid, which are generally prevalent in the environment. Silica (silicon dioxide) belongs to the most common mineral group, silicate minerals. Silica is inert in the environment and does not present an environmental concern with respect to soil chemistry. Aluminum is the third most abundant element in the earth's crust, forming some of the most common minerals, such as feldspars, micas, and clays. Natural soil concentrations of aluminum ranging from 10,000 to 300,000 parts per million have been documented (Lindsay 1979). These levels vary depending on numerous environmental factors, including climate, parent rock materials from which the soils were formed, vegetation, and soil moisture alkalinity/acidity. The solubility of aluminum is greater in acidic and highly alkaline soils than in neutral pH conditions. Aluminum eventually oxidizes to Al_2O_3 (aluminum oxide) over time, depending on its size and form and the environmental conditions.

The chaff fibers have an anti-clumping agent (Neofat – 90 percent stearic acid and 10 percent palmitic acid) to assist with rapid dispersal of the fibers during deployment (Air Force 1997). Stearic acid is an animal fat that degrades when exposed to light and air.

A single bundle of chaff consists of the filaments in an 8-inch long rectangular tube or cartridge, a plastic piston, a cushioned spacer, and two plastic pieces, each 1/8-inch thick by 1-inch by 1-inch. The chaff dispenser remains in the aircraft. The plastic end caps and spacer fall to the ground when chaff is dispensed. Spacers are spongy material (felt) designed to absorb the force of

release. Figure 1 illustrates the components of a chaff cartridge. Table 1 lists the components of the silica core and the aluminum coating. Table 2 presents the characteristics of RR-188 or RR-170 chaff.

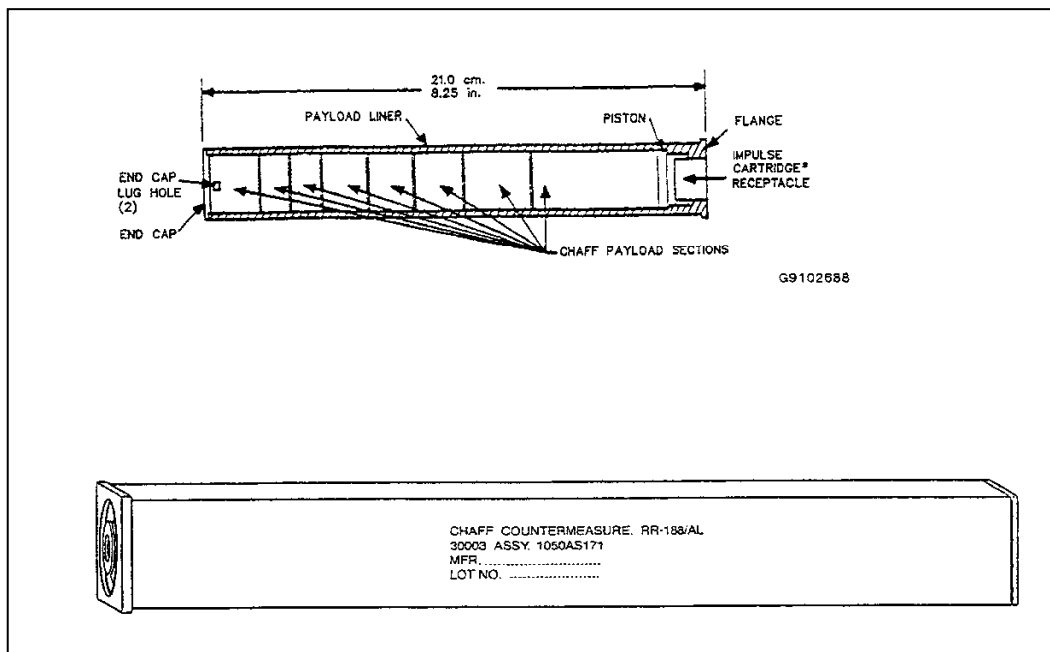


Figure 1. RR-188 or RR-170A/AL is a single cartridge containing 400,000 chaff dipoles, each in 8 cuts, a plastic end cap, piston, and felt pad.

Table 1. Components of RR-188 or RR-170 Chaff

Element	Chemical Symbol	Percent (by weight)
Silica Core		
Silicon dioxide	SiO ₂	52-56
Alumina	Al ₂ O ₃	12-16
Calcium Oxide and Magnesium Oxide	CaO and MgO	16-25
Boron Oxide	B ₂ O ₃	8-13
Sodium Oxide and Potassium Oxide	Na ₂ O and K ₂ O	1-4
Iron Oxide	Fe ₂ O ₃	1 or less
Aluminum Coating (Typically Alloy 1145)		
Aluminum	Al	99.45 minimum
Silicon and Iron	Si and Fe	0.55 maximum
Copper	Cu	0.05 maximum
Manganese	Mn	0.05 maximum
Magnesium	Mg	0.05 maximum
Zinc	Zn	0.05 maximum
Vanadium	V	0.05 maximum
Titanium	Ti	0.03 maximum
Others		0.03 maximum

Source: Air Force 1997

Table 2. Characteristics of RR-188 or RR-170 Chaff

<i>Attribute</i>	<i>RR-188</i>
Aircraft	F-15C, F-15E, F-22A
Composition	Aluminum coated silica
Ejection Mode	Pyrotechnic
Configuration	Rectangular tube cartridge
Size	8 x 1 x 1 inches (8 cubic inches)
Number of Dipoles	5.46 million
Dipole Size (cross-section)	1 mil (diameter)
Impulse Cartridge	BBU-35/B
Other Comments	Cartridge stays in aircraft; less interference with FAA radar (no D and E bands)

Source: Air Force 1997

RR-170 A/AL chaff is similar to RR-188 except that RR-170 A/AL is combat coded chaff to reflect tracking radar. RR-170 A/AL has approximately 400,000 dipoles, each in 8 cuts. Other than the cut of the dipoles, RR-170 A/AL chaff is essentially the same as RR-188 chaff in materials and cartridge design. A felt spacer, 1-inch x 1-inch x 1/8-inch end cap, a 1-inch x 1-inch x 1/4-inch piston, and the chaff dipoles are dispersed when the chaff bundle is deployed.

The F-22 uses the same chaff material in a slightly different chaff cartridge to expedite clean ejection of the chaff. The chaff cartridge design is less likely to leave debris of any kind in the dispenser bay yet still provides robust chaff dispensing. Figure 2 is a photograph of an F-22 chaff cartridge. The RR-180/AL for F-22 use has chaff packaged in soft packs that have a somewhat fewer number of dipoles per cut when compared with RR-170 chaff.

RR-180/AL chaff is similar to the RR-170 A/AL chaff cartridge with the primary exception that RR-180/AL chaff is contained in a dual chaff cartridge (see Figure 2). The dual chaff cartridge is a 1-inch x 1-inch x 8-inch cartridge with a plastic separator, or I-beam, dividing two hyperfine (0.7 millimeter diameter) chaff cartridges. The I-beam separator uses some space and the RR-180/AL chaff has approximately 340,000 dipoles each. Figure 2 presents the RR-180/AL chaff plastic cartridge, two pistons with attached felt spacers, and two end caps also with attached felt spacers, and the chaff dipoles before dispersion. Each of the two end caps and pistons is an approximately 1/2-inch x 1/4-inch x 1-inch plastic or nylon piece with attached felt spacer which falls to the surface when each chaff bundle is deployed. There are three parchment paper wrappers measuring approximately two inches by three inches in each of the dual chaff cartridge tubes. This parchment paper wrapping prevents the premature deployment of chaff too near the F-22 chaff distribution rack (Air Force 2008).

A2 Chaff Ejection

Chaff is ejected from aircraft pyrotechnically using a BBU-35/B impulse cartridge. Pyrotechnic ejection uses hot gases generated by an explosive impulse charge. The gases push the small piston down the chaff-filled tube. In the case of F-22 chaff, six paper pieces, two small plastic end cap, and two small plastic or nylon pistons are ejected along with the chaff fibers. The plastic

tube remains within the aircraft. Residual materials from chaff deployment consist of four 2 by 3 inch pieces of paper, four ½ by 1 by 1/8 inch pieces of plastic or nylon, and the chaff. Table 3 lists the characteristics of BBU-35/B impulse cartridges used to pyrotechnically eject chaff.

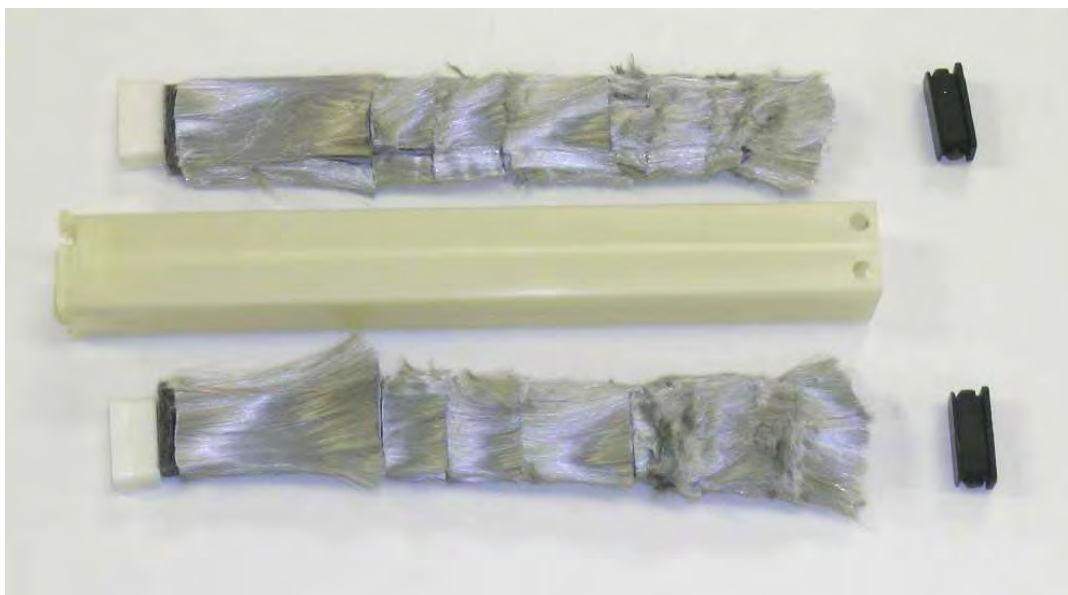


Figure 2. RR-180/AL chaff is a dual chaff cartridge with unconstrained hyperfine (.7 millimeter diameter) chaff, 340,000 dipoles per cut, in an I-beam reinforced cartridge.

Table 3. BBU-35/B Impulse Charges Used to Eject Chaff

Component	BBU-35/B
Overall Size	0.625 inches x 0.530 inches
Overall Volume	0.163 inches ³
Total Explosive Volume	0.034 inches ³
Bridgewire	Trophet A 0.0025 inches x 0.15 inches
Initiation Charge	0.008 cubic inches 130 mg 7,650 psi boron 20% potassium perchlorate 80% *
Booster Charge	0.008 cubic inches 105 mg 7030 psi boron 18% potassium nitrate 82%
Main Charge	0.017 cubic inches 250 mg loose fill RDX ** pellets 38.2% potassium perchlorate 30.5% boron 3.9% potassium nitrate 15.3% super floss 4.6% Viton A 7.6%

Source: Air Force 1997

Upon release from an aircraft, chaff forms a cloud approximately 30 meters in diameter in less than one second under normal conditions. Quality standards for chaff cartridges require that

they demonstrate ejection of 98 percent of the chaff in undamaged condition, with a reliability of 95 percent at a 95 percent confidence level. They must also be able to withstand a variety of environmental conditions that might be encountered during storage, shipment, and operation.

Table 4 lists performance requirements for chaff. To achieve the performance standards and not be rejected, chaff is typically manufactured to a reliability of 99 percent or greater.

Table 4. Performance Requirements for Chaff

Condition	Performance Requirement	
High Temperature	Up to +165 degrees Fahrenheit	
Low Temperature	Down to -65 °F	
Temperature Shock	Shock from -70 °F to +165 °F	
Temperature Altitude	Combined temperature altitude conditions up to 70,000 feet	
Humidity	Up to 95 percent relative humidity	
Sand and Dust	Sand and dust encountered in desert regions subject to high sand dust conditions and blowing sand and dust particles	
Accelerations/ Axis	G-Level	Time (minute)
Transverse-Left (X)	9.0	1
Transverse-Right (-X)	3.0	1
Transverse (Z)	4.5	1
Transverse (-Z)	13.5	1
Lateral-Aft (-Y)	6.0	1
Lateral-Forward (Y)	6.0	1
Shock (Transmit)	Shock encountered during aircraft flight	
Vibration	Vibration encountered during aircraft flight	
Free Fall Drop	Shock encountered during unpackaged item drop	
Vibration (Repetitive)	Vibration encountered during rough handling of packaged item	
Three Foot Drop	Shock encountered during rough handling of packaged item	

Note: Cartridge must be capable of total ejection of chaff from the cartridge liner under these conditions.

Source: Air Force 1997

A3 Policies and Regulations on Chaff Use

Current Air Force policy on use of chaff and flares was established by the Airspace Subgroup of Headquarter Air Force Flight Standards Agency in 1993. It requires units to obtain frequency clearance from the Air Force Frequency Management Center and the FAA prior to using chaff to ensure that training with chaff is conducted on a non-interference basis. This ensures electromagnetic compatibility between the FAA, the Federal Communications Commission, and

Department of Defense (DoD) agencies. The Air Force does not place any restrictions on the use of chaff provided those conditions are met (Air Force 1997).

Air Force Instruction (AFI) 13-201, U.S. Air Force Airspace Management, November 2007. This guidance establishes practices to decrease disturbance from flight operations that might cause adverse public reaction. It emphasizes the Air Force's responsibility to ensure that the public is protected to the maximum extent practicable from hazards and effects associated with flight operations.

AFI 11-214 Aircrew and Weapons Director and Terminal Attack Controller Procedures for Air Operations, December 2005. This instruction delineates procedures for chaff and flare use. It prohibits use unless in an approved area.

A4 References

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Appendix B

Characteristics and Analysis of Flares

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APPENDIX B CHARACTERISTICS AND ANALYSIS OF FLARES

B1 Introduction

The F-22 uses MJU-10/B self-protection flares in approved airspace over parts of Alaska. The F-15E and F-15C historically deployed MJU-7 A/B and MJU-10/B self-protection flares. The Self-protection flares are magnesium pellets that, when ignited, burn for 3.5 to 5 seconds at 2,000 degrees Fahrenheit. The burn temperature is hotter than the exhaust of an aircraft, and therefore attracts and decoys heat-seeking weapons targeted on the aircraft. Flares are used in pilot training to develop the near instinctive reactions to a threat that are critical to combat survival. This appendix describes flare composition, ejection, risks, and associated regulations.

B2 Flare Composition

Self-protection flares are primarily mixtures of magnesium and Teflon (polytetrafluoroethylene) molded into rectangular shapes (United States Air Force [Air Force] 1997). Longitudinal grooves provide space for materials that aid in ignition such as:

- First fire materials: potassium perchlorate, boron powder, magnesium powder, barium chromate, Viton A, or Fluorel binder.
- Immediate fire materials: magnesium powder, Teflon, Viton A, or Fluorel
- Dip coat: magnesium powder, Teflon, Viton A or Fluorel

Typically, flares are wrapped with an aluminum-coated mylar or filament-reinforced tape (wrapping) and inserted into an aluminum (0.03 inches thick) case that is closed with a felt spacer and a small plastic end cap (Air Force 1997). The top of the case has a pyrotechnic impulse cartridge that is activated electrically to produce hot gases that push a piston, the flare material, and the end cap out of the aircraft into the airstream. Table 1 provides a description of MJU-10/B and MJU-7 A/B flare components. Typical flare composition and debris are summarized in Table 2. Figure 1 is an illustration of an MJU-10/B flare, Figure 2 an illustration of an MJU-7 A/B flare. The MJU-7 (T-1) flare simulator is the same size as described for the MJU-7 A/B flare.

Table 1. Description of MJU-10/B and MJU-7 A/B Flares

<i>Attribute</i>	<i>MJU-10/B</i>	<i>MJU-7 A/B</i>
Aircraft	F-15, F-22	F-15
Mode	Semi-Parasitic	Semi-Parasitic
Configuration	Rectangle	Rectangle
Size	2 x 2 x 8 inches (32 cubic inches)	1 x 2 x 8 inches (16 cubic inches)

<i>Attribute</i>	<i>MJU-10/B</i>	<i>MJU-7 A/B</i>
Impulse Cartridge	BBU-36/B	BBU-36/B
Safe and Initiation Device (S&I)	Slider Assembly	Slider Assembly
Weight (nominal)	40 ounces	13 ounces

Table 2. Typical Composition of MJU-10/B and MJU-7 A/B Self-Protection Flares

<i>Part</i>	<i>Components</i>
<i>Combustible</i>	
Flare Pellet	Polytetrafluoroethylene (Teflon) ($-\text{[C}_2\text{F}_4\text{]}_n - n=20,000$ units) Magnesium (Mg) Fluoroelastomer (Viton, Fluorel, Hytemp)
First Fire Mixture	Boron (B) Magnesium (Mg) Potassium perchlorate (KClO_4) Barium chromate (BaCrO_4) Fluoroelastomer
Immediate Fire/ Dip Coat	Polytetrafluoroethylene (Teflon) ($-\text{[C}_2\text{F}_4\text{]}_n - n=20,000$ units) Magnesium (Mg) Fluoroelastomer
<i>Assemblage (Residual Components)</i>	
Aluminum Wrap	Mylar or filament tape bonded to aluminum tape
End Cap	Plastic (nylon)
Felt Spacers	Felt pads (0.25 inches by cross section of flare)
Safe & Initiation (S&I) Device (MJU-7 A/B only)	Plastic (nylon, tefzel, zytel)
Piston	Plastic (nylon, tefzel, zytel)

Source: Air Force 1997

3.0 Flare Ejection

The MJU-10/B and the MJU-7 A/B are semi-parasitic type flares that use a BBU-36/B impulse cartridge. In these flares, a slider assembly incorporates an initiation pellet (640 milligrams of magnesium, Teflon, and Viton A or Fluorel binder). This pellet is ignited by the impulse cartridge, and hot gases reach the flare as the slider exits the case, exposing a fire passage from the initiation pellet to the first fire mixture on top of the flare pellet. Table 3 describes the components of BBU-36/B impulse charges.

Flares are tested to ensure they meet performance requirements in terms of ejection, ignition, and effective radiant intensity. If the number of failures exceeds the upper control quality assurance acceptance level, the flares are returned to the manufacturer. A statistical sample is taken to ensure that approximately 99 percent must be judged reliable for ejection, ignition, and intensity.

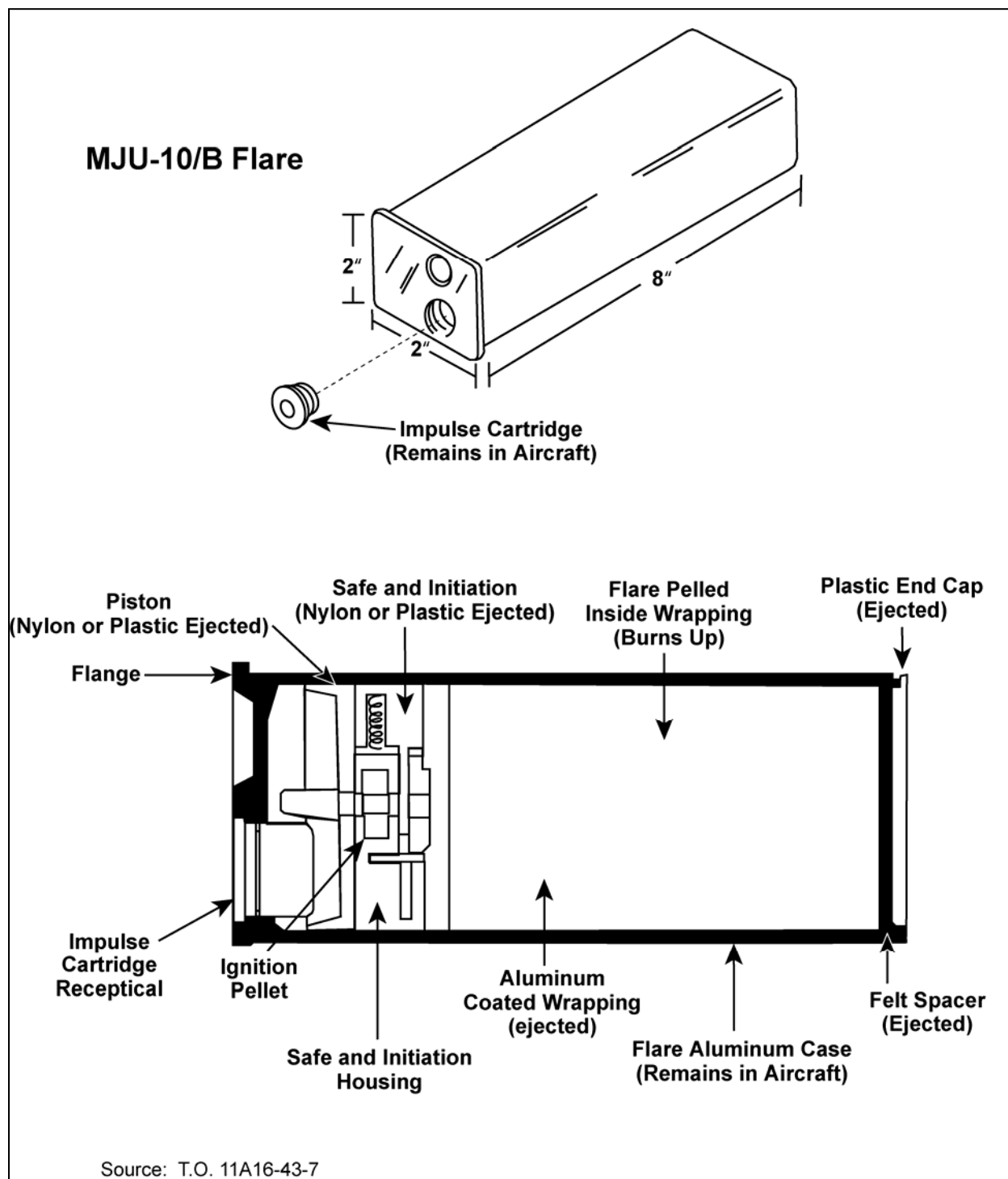


Figure 1. MJU-10/B Flare

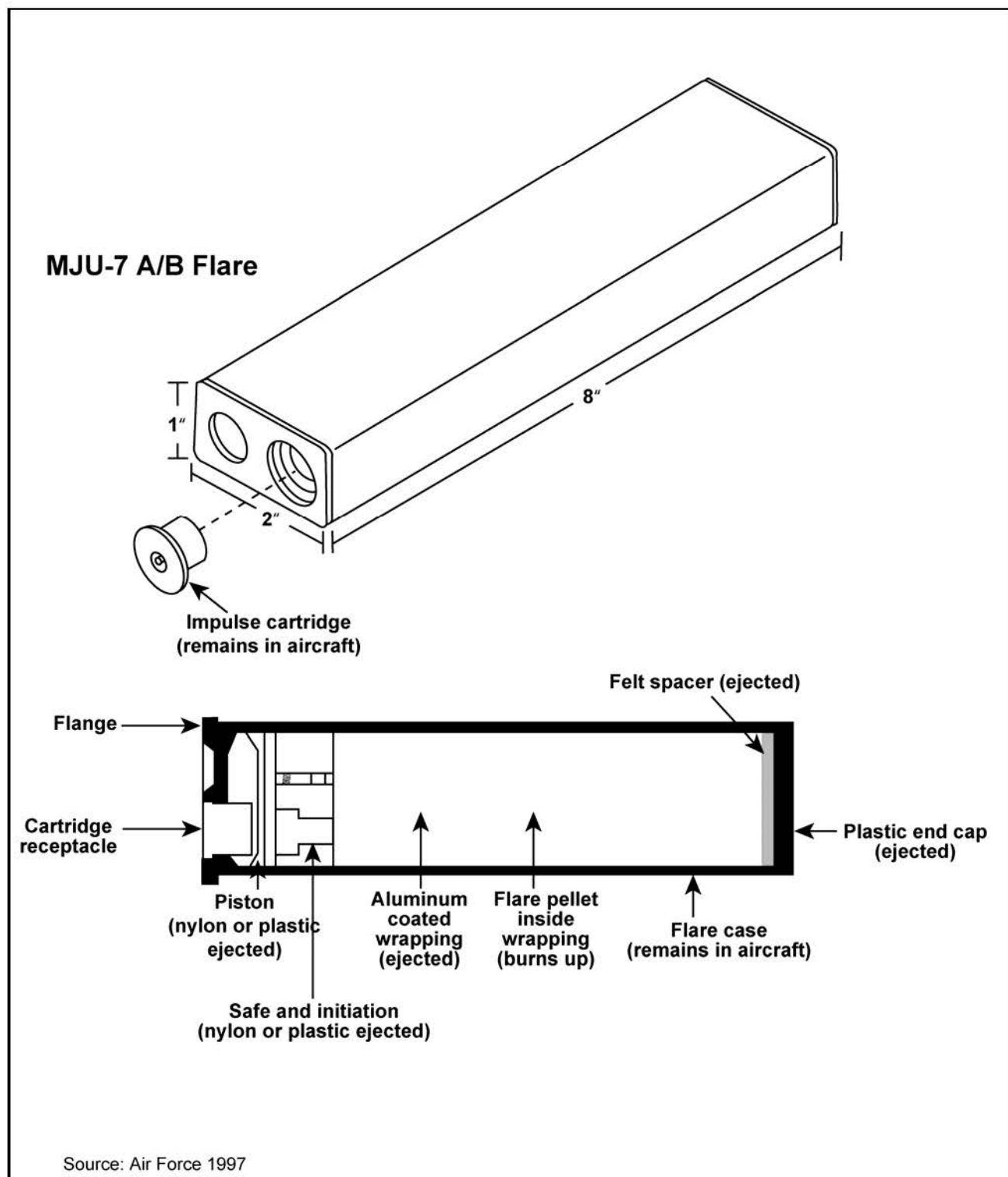


Figure 2. MJU-7 A/B Flare

Flare failure would occur if the flare failed to eject, did not burn properly, or failed to ignite upon ejection. For training use within the airspace, a dud flare would be one that successfully ejected but failed to ignite. That probability is projected to be 0.01 percent based upon dud flares located during military range cleanup.

B4 Risks Associated with Flare Use

Risks associated with the use of flares fall within two main categories: the risk of fire from a flare and the risk of being struck by a residual flare component.

B4.1 Fire Risk

Fire risk associated with flares stems from an unlikely, but possible scenario which results in the flare reaching the ground or vegetation while still burning. The altitude from which flares are dropped is strictly regulated by the airspace manager, and is based on a number of factors including flare burn-out rate. The flare burn-out rate is shown in Table 4. Defensive flares typically burn out in 3.5 to 5 seconds, during which time the flare will have fallen between 200 and 400 feet. Specific defensive flare burn-out rates are classified. Table 4 is based on conditions that assume zero aerodynamic drag and a constant acceleration rate of 32.2 feet per second per second.

$$D = (V_o * T) + (0.5 * (A * T^2))$$

Where:

D = Distance

Vo = Initial Velocity = 0

T = Time (in Seconds)

A = Acceleration

Table 3. Components of BBU-36/B Impulse Charges

<i>Component</i>	<i>BBU-36/B</i>
Overall Size	0.740 x 0.550 inches
Overall Volume	0.236 cubic inches
Total Explosive Volume	0.081 cubic inches
Bridgewire	Trophet A
Closure Disk	Scribed disc, washer

<i>Component</i>	<i>BBU-36/B</i>
<i>Initiation Charge</i>	
Volume	0.01 cubic inches
Weight	100 mg
Compaction	6,200 psi
Composition	42.5% boron 52.5 % potassium perchlorate 5.0% Viton A
<i>Booster Charge</i>	
Volume	0.01 cubic inches
Weight	150 mg
Compaction	5,100 psi
Composition	20% boron 80% potassium nitrate
<i>Main Charge</i>	
Volume	0.061 cubic inches
Weight	655 mg
Compaction	Loose fill
Composition	Hercules #2400 smokeless powder (50-77% nitrocellulose, 15-43% nitroglycerine)

Source: Air Force 1997

Table 4. Flare Burn-out Rates

<i>Time (in Sec)</i>	<i>Acceleration</i>	<i>Distance (in feet)</i>
0.5	32.2	4.025
1.0	32.2	16.100
1.5	32.2	36.225
2.0	32.2	64.400
2.5	32.2	100.625
3.0	32.2	144.900
3.5	32.2	197.225
4.0	32.2	257.600
4.5	32.2	326.025
5.0	32.2	402.500
5.5	32.2	487.025
6.0	32.2	579.600
6.5	32.2	680.225
7.0	32.2	788.900
7.5	32.2	905.625
8.0	32.2	1030.400
8.5	32.2	1163.225
9.0	32.2	1304.100
9.5	32.2	1453.025
10.0	32.2	1610.000

Note: Initial velocity is assumed to be zero.

4.2 Flare Strike Risk

Residual flare materials are those that are not completely consumed during ignition and fall to the ground, creating the risk of striking a person or property. Residual material from the MJU-10/B and the MJU-7 A/B consists of an end cap, an initiation assembly (safe and initiation device [S&I]), a piston, one or two felt spacers, and an aluminum-coated mylar wrapper (Table 5). For both flare types, the wrapper may be partially consumed during ignition, so the wrapping residual material could range in size from the smallest size, 1 inch by 1 inch, to the largest size, 4 inches by 13 inches. The size of the residual wrapping material would depend upon the amount of combustion that occurred as the flare was deployed.

Table 5. Residual Material from MJU-10/B and MJU-7 A/B Flares

<i>Component</i>	<i>Weight</i>
<i>MJU-10/B</i>	
End cap	0.0144 pounds
Safe & Initiation (S&I) device	0.0453 pounds
Piston	0.0144 pounds
Felt spacer	0.0025 pounds
Wrapper (4 inches x 13 inches)	0.0430 pounds
<i>MJU-7 A/B</i>	
End cap	0.0072 pounds
Safe & Initiation (S&I) device	0.0453 pounds
Piston	0.0072 pounds
Felt spacer	0.0011 pounds
Wrapper (3 inches x 13 inches)	0.0322 pounds

After ignition, as described in section 3.0, most residual components of the MJU-10/B and the MJU-7 A/B flare have high surface to mass ratios and are not judged capable of damage or injury when they impact the surface. One component of the MJU-10/B and the MJU-7 A/B flare, referred to as the S&I device, has a weight of approximately 0.725 ounces (0.0453 pounds). It is sized and shaped such that it is capable of achieving a terminal velocity that could cause injury if it struck a person.

The following discussion addresses the likelihood of an S&I device striking a person and the effect if such a strike were to occur.

B4.2.1 Technical Approach

Joint Base Elmendorf-Richardson (JBER) aircraft training flights are distributed randomly and uniformly within the Military Operations Areas (MOAs). Avoidance areas that are designated for low altitude flight need not be avoided for higher altitude flight. Flare component release altitudes and angles of release are sufficiently random that ground impact locations of flare materials are also assumed to be uniformly distributed under the MOAs.

For any particular residual component of a released flare, the conditional probability that it strikes a particular object is equal to the ratio of the object area to the total area of the MOA. For

multiple objects (i.e., people, structures, vehicles), the probability of striking any one object is the ratio of the sum of object areas to the MOA. The frequency of a residual component striking one of many objects is the frequency of releasing residual components times the conditional probability of striking one of the many objects per given release.

In equation form, this relationship is:

$$\text{Strike frequency} = \text{component drop frequency in MOA} \times \frac{\text{area of object} \times \text{number of objects in MOA}}{\text{MOA}(\text{area})}$$

The potential consequences of a residual component with high velocity and momentum striking particular objects are postulated as follows:

Striking the head of an unprotected individual: possible concussion

Striking the body of an unprotected individual: possible injury

Striking a private structure: possible damage

Striking a private vehicle: possible damage (potential injury if vehicle moving)

The effect of the impact of a residual MJU-7 A/B or MJU-10/B component from Table 6 is judged by computing the component's terminal velocity and momentum.

Terminal velocity (V_T) is calculated by the equation:

$$V_T = \left[\frac{2}{\rho} \left(\frac{W}{A \times C_d} \right) \right]^{0.5} = 29 \times \left(\frac{W}{A} \right)^{0.5}$$

Where: V_T = Terminal Velocity (in Feet/Second)

ρ = Nominal Air Density (2.378×10^{-3} lbs-sec²/feet⁴)

W = Weight (in Pounds)

A = Surface Area Facing the Air stream (in feet²)

C_d = Drag Coefficient = 1.0

Drag coefficients are approximately 1.0 over a wide range of velocities and Reynolds numbers (Re) for irregular objects (e.g., non-spherical). Using this drag coefficient, the computed terminal velocities (Table 7) produce Re values within this range ($Re < 2 \times 10^5$), which justifies the use of the drag coefficient.

The weights and geometries of major flare components are approximately as listed in Table 6.

Terminal velocity momentums of these components are computed based on maximum (two square inches) and minimum (one square inch) areas and are listed in Table 7. Actual values would be between these extremes. The momentum values are the product of mass (in slugs)

and velocity. A slug is defined as the mass that, when acted upon by a 1-pound force, is given an acceleration of 1.0 feet/sec².

Table 6. MJU-10/B and MJU-7 A/B Flare Major Component Properties

<i>Component</i>	<i>Geometry</i>	<i>Dimensions (inches)</i>	<i>Weight (Pounds)</i>
<i>MJU-10/B</i>			
S&I device	Rectangular solid	2 × 0.825 × 0.5	0.0453
Piston	Rectangular open	2 × 2 × 0.25	0.0144
End Caps	Rectangular plate	2 × 2 × 0.125	0.0144
<i>MJU-7 A/B</i>			
S&I device	Rectangular solid	2 × 0.825 × 0.5	0.0453
Piston	Rectangular open	2 × 0.825 × 0.5	0.0072
End Caps	Rectangular plate	1 × 2 × 0.125	0.0072

Table 7. MJU-10/B and MJU-7 A/B Flare Component Hazard Assessment

<i>Component</i>	<i>Maximum Surface Area</i>			<i>Minimum Surface Area</i>		
	<i>Area (in²)</i>	<i>Terminal Velocity (ft/sec)</i>	<i>Momentum (lb-sec)</i>	<i>Area (in²)</i>	<i>Terminal Velocity (ft/sec)</i>	<i>Momentum (lb-sec)</i>
<i>MJU-10/B</i>						
S&I device	1.65	58	0.08	0.41	115	0.16
Piston	4.0	21	0.009	0.50	59	0.03
End Cap	4.0	21	0.009	0.25	84	0.04
<i>MJU-7 A/B</i>						
S&I device	1.65	58	0.08	0.41	115	0.16
Piston	1.65	23	0.005	0.41	46	0.01
End Caps	2.0	21	0.005	0.13	84	0.02

The focus of this analysis will be the S&I device. Other flare components are not calculated to achieve a momentum that could cause damage.

The maximum momentum of the S&I device would vary between 0.08 and 0.16 pound-seconds depending upon orientation. In this momentum range, an injury is postulated that could be equivalent to a bruise from a large hailstone. Approximately 20 percent of any strikes could be to the head. A potentially more serious injury could be expected if the head were struck.

As a basis of comparison, laboratory experimentation in accident pathology indicates that there is a 90 percent probability that brain concussions would result from an impulse of 0.70 pound-seconds to the head, and less than a 1 percent probability from impulses less than 0.10 pound-seconds (Air Force 1997). The only MJU-7 A/B or MJU-10/B component with momentum values near 0.10 pound-seconds is the S&I device with a momentum between 0.08 and 0.16 pound-seconds. A strike of an S&I device to the head has approximately a 1 percent probability of causing a concussion.

What would be the likelihood of a hailstone sized S&I device striking an individual? People at risk of being struck by a dropped S&I device are assumed to be standing outdoors under a MOA (people in structures or vehicles are assumed protected). The dimensions of an average

person are approximately 5 feet 6 inches high by 2 feet wide by 1 foot deep (men 5 feet 10 inches; women 5 feet 4 inches; children varied). The S&I device is expected to strike ground objects at an angle of 80 degrees or greater to the ground, assuming 80 degrees to the ground allows for possible wind or other drift effects. With the flare component falling at 80 degrees to the ground, a person's body (5.5 × 2 × 1 feet) projects an area of 3.9 feet² normal to the path of the dropped component. In a normal case, a person would be outdoors and unprotected 10 percent of the time based on Department of Energy and Environmental Protection Agency national studies (Tennessee Valley Authority 2003; Klepeis et al. 2001). In the case of hunting or fishing, a person is assumed to be out of doors and unprotected 2/3 of the day (although a person would probably be wearing a hat or other head covering during such activity).

The frequencies of a strike to an unprotected person can be computed based on the data and assumptions presented above. Flight maneuvers to deploy flares are assumed to be randomly distributed throughout the training airspace.

A personnel injury could occur if an S&I device struck an unprotected person. The frequency of striking a person is:

$$\text{Injury frequency} = \text{comp drop freq} \times \frac{\text{body area} \times \text{pop. density} \times \text{Fract unprot} \times \text{MOA}(\text{area})}{\text{MOA}(\text{area})}$$

Under the Stony MOAs, this calculates to approximately:

$$\begin{aligned} \text{Injury frequency} &= 10,000 / \text{year} \times 3.9 \text{ ft}^2 / \text{pers} \times 0.1 \text{ pers} / \text{mi}^2 \times 0.67 \times 3.59 \times 10^{-8} \text{ mi}^2 / \text{ft}^2 \\ &= 0.00009 \text{ injuries/year} \end{aligned}$$

This means that in a representative Alaskan rural area beneath a MOA used extensively for pilot training (see Table 2.2-4), the annual expected person strike frequency would be less than one person in every 10,000 years.

The maximum momentum of the S&I device, either from an MJU-7 A/B or an MJU-10/B flare, would vary between 0.08 and 0.16 pound-seconds depending upon orientation of the falling S&I device. In this momentum range, an injury is postulated that could be equivalent to a bruise from a large hailstone. Approximately 20 percent of any strikes could be to the head.

As a basis of comparison, laboratory experimentation in accident pathology indicates that there is a less than a 1 percent probability of a brain concussion from an impulse of less than 0.10 pound-seconds to the head, and a 90 percent probability that brain concussions would result from an impulse of 0.70 pound-seconds to the head (Air Force 1997). The only MJU-7 A/B or MJU-10/B component with momentum values near 0.10 pound-seconds is the S&I device with a momentum between 0.08 and 0.16 pound-seconds. A strike of an S&I device to the head has approximately a 1 percent probability of causing a concussion.

This means that there would be an approximately 1 in 100 chance of a concussion in 10,000 years of flare use over the Stony MOAs. This level of risk is negligible.

The S&I device maximum momentum would vary between 0.08 and 0.16 pound-seconds depending upon orientation. A strike to a vehicle could cause a cosmetic dent similar to a hailstone impact. Although not numerically estimated, a strike to a moving vehicle could result in a vehicle accident.

B5 Policies and Regulations Addressing Flare Use

Air Force policy on flare use was established by the Airspace Subgroup of Headquarters Air Force Flight Standards Agency in 1993 (Memorandum from John R. Williams, 28 June 1993) (Air Force 1997). This policy permits flare drops over military-owned or controlled land and in Warning Areas. Flare drops are permitted in MOAs and Military Training Routes (MTRs) only when an environmental analysis has been completed. Minimum altitudes must be adhered to. Flare drops must also comply with established written range regulations and procedures.

Air Force Instruction (AFI) 11-214 prohibits using flare systems except in approved areas with intent to dispense, and sets certain conditions for employment of flares. Flares are authorized over government-owned and controlled property and over-water Warning Areas with no minimum altitude restrictions when there is no fire hazard. If a fire hazard exists, minimum altitudes will be maintained in accordance with the applicable directive or range order. An Air Combat Command supplement to AFI 11-214 (15 October 2003) prescribes a minimum flare employment altitude of 2,000 feet above ground level (AGL) over non-government owned or controlled property (Air Force 1997).

JBER has a more stringent policy regarding flare use than that outlined in AFI 11-214. Within JBER airspaces approved for flare use, flares may only be deployed above 5,000 feet AGL from June 1 through September 30. For the remainder of the year, the minimum altitude for flare use is 2,000 feet AGL.

B6 References

- Klepeis, Neil E., William C. Nelson, Wayne R. Ott, John P. Robinson, Andy M. Tsang, Paul Switzer, Joeseeph V. Behar, Stephen C. Hern, and William H. Engelmann. The National Human Activity Pattern Survey (NHAPS) a resource for assessing exposure to environmental pollutants. <http://exposurescience.org/research.shtml#NHAPS>
- Science Applications International Corporation. 2006. Draft Environmental Effects of Defensive Countermeasures: An Update. Prepared for U.S. Air Force Air Combat Command.
- Tennessee Valley Authority. 2003. On the Air, Technical Notes on Important Air Quality Issues, Outdoor Ozone Monitors Over-Estimate Actual Human Ozone Exposure. <http://www.tva.gov/environment/air/ontheair/pdf/outdoor.pdf>
- United States Air Force (Air Force). 1997. Environmental Effects of Self Protection Chaff and Flares. Final Report. August.

United States Bureau of the Census. 2000. Table DP-1 Profile of General Demographic Characteristics. Census 2000 SF-1. Available on-line at <http://factfinder.census.gov>.

Appendix C

Public and Agency Outreach

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DEPARTMENT OF THE AIR FORCE
PACIFIC AIR FORCES

MEMORANDUM FOR SEE DISTRIBUTION

18 Nov 2010

FROM: 673 CES/CC
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson AK 99506-3240

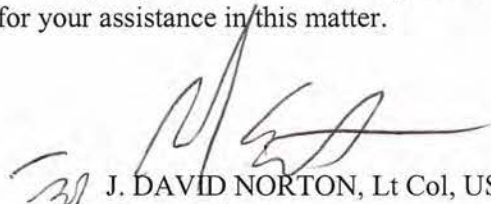
SUBJECT: F-22 Plus-Up Environmental Assessment

1. The United States Air Force (Air Force) is preparing an F-22 Plus-Up Environmental Assessment (EA) to evaluate the potential environmental consequences of a proposal to add seven F-22 aircraft to the Joint Base Elmendorf-Richardson (JBER) inventory. The proposed action would replace F-15 aircraft which were relocated from JBER in September 2010. Under the F-22 Beddown Environmental Assessment completed in 2006, two of the three JBER-based F-15 squadrons left JBER and two F-22 squadrons arrived. Subsequently, the third F-15 squadron was reassigned from JBER. This Plus-Up EA will address two alternatives: the proposed addition of seven F-22 aircraft to the existing F-22 squadrons and the No Action alternative. The Proposed Action under consideration would not require expansion of existing airspace or construction of any new facilities.

2. The Air Force will publish a notice of EA preparation in the Anchorage Daily News, the Mat-Su Valley Frontiersman, and the Eagle River Star.

3. In an effort to analyze the potential effects of this Proposed Action, the Air Force or its contractor, SAIC, may be contacting you in their data collection efforts. Please provide your comments or information to the proposed EA not later than 6 January 2011 in order to be incorporated in the preparation of the draft EA. In advance, we thank you for your assistance in this activity.

4. If you have any specific questions about the proposal, we would like to hear from you. Please feel free to contact Ms. Ellen Godden at the above address or at (907) 552-7483. General questions may be directed to Mr. Bob Hall at (907) 552-8152. Thank you for your assistance in this matter.


J. DAVID NORTON, Lt Col, USAF
Commander

Attachment:
Distribution List

F-22 Plus-Up Environmental Assessment
Joint Base Elmendorf-Richardson, Alaska
Agency Coordination
EA Memorandum Distribution List

Federal Aviation Administration, Alaska Region
ATTN: Bob Lewis
222 West 7th Ave. #14
Anchorage, AK 99513

U.S. Department of Agriculture
ATTN: Robert Jones
Natural Resources Conservation Service
800 W. Evergreen Ave., Suite 100
Palmer, AK 99545-6539

U.S. Department of Interior
ATTN: Pamela Bergmann
Office of Environmental Policy
1689 C Street, Rm. 119
Anchorage, AK 99501

U.S. Department of Transportation
ATTN: David Miller
Federal Highway Administration
P.O. Box 21648
Juneau, AK 99802-1648

U.S. Department of Transportation
ATTN: Robert Bouchard
Maritime Administration
1200 New Jersey Ave., SE (mar-510,#w21-224
Washington, DC 20590

U.S. Department of Interior
ATTN: Edward Parisian
Bureau of Indian Affairs, Alaska Regional Office
P.O. Box 25520
Juneau, AK 99802

U.S. Department of Transportation
ATTN: Richard Krochalis
Federal Transit Administration, Regional 10
915 Second Ave., Ste. 3142
Seattle, WA 98174-1002

U.S. Fish and Wildlife Service
ATTN: Ann Rappoport
Anchorage Fish & Wildlife Field Office
605 4th Ave., Rm. G-61
Anchorage, AK 99501

United States Coast Guard
ATTN: CAPT Jason Fosdick
Sector Anchorage
510 L Street, Ste. 100
Anchorage, AK 99501

National Marine Fisheries Service
ATTN: Brad Smith
Protected Resources Div/Habitat Consv
222 W. 7th Avenue, Rm. 517
Anchorage, AK 99513

National Park Service
ATTN: Sue Masica
Alaska Regional Office
240 W 5th Avenue, Room 114
Anchorage, AK 99501

Bureau of Land Management
ATTN: Gary Reimer
Anchorage District Office
4700 BLM Rd.
Anchorage, AK 99507

U.S. Environmental Protection Agency, Region 10
ATTN: Jacques Gusmano
222 West 7th Ave.
Room 537
Anchorage, AK 99513-7588

Alaska Department of Environmental Conservation
ATTN: Deb Caillouet
555 Cordova
Anchorage, AK 99501

Alaska Department of Fish and Game
ATTN: Mark Burch
Division of Wildlife Conservation
333 Raspberry Rd.
Anchorage, AK 99518-1599

Alaska Department of Military and Veterans Affairs
ATTN: MAJ GEN Thomas Katkus
PO Box 5800
Camp Denali
JBER, AK 99505

Alaska Department of Natural Resources
ATTN: Thomas Irwin
Office of the Commissioner
550 W. 7th Avenue, Suite 1400
Anchorage, AK 99501

Alaska Department of Natural Resources
ATTN: Judith Bittner
Office of History and Archaeology

550 W 7th Avenue, Ste. 1310
Anchorage, AK 99501

Alaska Department of Natural Resources
ATTN: James King
Parks and Outdoor Recreation
550 W. 7th Ave., Ste 1380
Anchorage, AK 99501-3561

Alaska Department of Transportation
ATTN: Lance Wilbur, AICP
Central Region
4111 Aviation Ave.
Anchorage, AK 99501

Alaska Railroad Corporation
ATTN: Christopher Aadnesen
P.O. Box 107500
Anchorage, AK 99510

Ted Stevens Anchorage International Airport
ATTN: John Parrot
PO Box 196960
Anchorage, AK 99519

Anchorage Assembly
ATTN: Barbara Gruenstein
P.O. Box 196650
Anchorage, AK 99519

Municipality of Anchorage
ATTN: Debbie Sedwick
Anchorage Community Development Authority
245 W. 5th Ave., Ste. 122
Anchorage, AK 99501

Municipality of Anchorage
ATTN: Greg Jones
Community Planning & Development
4700 Elmore Road
Anchorage, AK 99507

Port MacKenzie
ATTN: Marc VanDongen
Matanuska-Susitna Borough
350 East Dahlia Ave
Palmer, AK 99645

Port of Anchorage
ATTN: William Sheffield
2000 Anchorage Port Rd.
Anchorage, AK 99501

Eagle River Community Council
ATTN: Michael Foster
13135 Old Glenn Hwy
Ste 200
Eagle River, AK 99577

Fairview Community Council
ATTN: Sharon Chamard
1121 E. 10th Ave.
Anchorage, AK 99501

Government Hill Community Council
ATTN: Bob French
P. O. Box 101677
Anchorage, AK 99510

Mountain View Community Council
ATTN: Don Crandall
P.O. Box 142824
Anchorage, AK 99514

Northeast Community Council
ATTN: Kevin Smestad
7600 Boundary Ave
Anchorage, AK 99504

Municipality of Anchorage
ATTN: Dan Sullivan
632 W. Sixth Ave.
Suite 840
Anchorage, AK 99501

Congressman Don Young
ATTN: Michael Anderson
2111 Rayburn House Office Building
Washington, DC 20515-0201

Congressman Don Young
ATTN: Chad Padgett
510 L Street
Suite 580
Anchorage, AK 99501

Senator Mark Begich
ATTN: Susanne Fleek
510 L Street
Suite 750
Anchorage, AK 99501

Senator Mark Begich
ATTN: David Ramseur
144 Russell Senate Office Building
Washington, DC 20510

Senator Lisa Murkowski
ATTN: Karen Knutson
709 Hart Senate Office Building
Washington, DC 20510-0202

Senator Lisa Murkowski
ATTN: Kevin Sweeney
510 L Street
Suite 550
Anchorage, AK 99501

State of Alaska
ATTN: Sean Parnell
PO Box 110001
Juneau, AK 99811-0001

Alaska Resources Library and Information Services
3211 Providence Dr.
Suite 111
Anchorage, AK 99508

Alaska State Court Law Library
303 K Street
Anchorage, AK 99501

Alaska State Library
P.O. Box 110571
Juneau, AK 99811

Delta Community Library
2291 Deborah St.
Delta Junction, AK 99737

Eagle Public Library
P.O. Box 45
Eagle, AK 99738

Fairbanks North Star Borough
Noel Wien Library
1215 Cowles St.
Fairbanks, AK 99701

Joint Base Elmendorf Richardson Library
123 Chilkoot Ave.
JBER, AK 99505

Lime Village School Library
P.O. Box LVD, Lime Village VIA
McGrath, AK, AK 99627

Martin Monsen Regional Library
P.O. Box 147
Naknek, AK 99633

Tanana Community and School Library
P.O. Box 109
Tanana, AK 99777

University of Alaska Fairbanks
Elmer E. Rasmuson Library
P.O. Box 756811
Fairbanks, AK 99775

Wasilla Public Library
391 N. Main St.
Wasilla, AK 99654



**DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA**


MEMORANDUM FOR SEE DISTRIBUTION

DEC 2 2010

FROM: 673 CES/CC
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson AK 99506-3240

SUBJECT: F-22 Plus-Up Environmental Assessment

1. The United States Air Force (Air Force) is preparing an F-22 Plus-Up Environmental Assessment (EA) to evaluate the potential environmental consequences of a proposal to add seven F-22 aircraft to the Joint Base Elmendorf-Richardson (JBER) inventory. The proposed action would replace F-15 aircraft which were relocated from JBER in September 2010. Under the F-22 Beddown Environmental Assessment completed in 2006, two of the three F-15 squadrons left JBER and two F-22 squadrons arrived. Subsequently, the third F-15 squadron was reassigned from JBER. This Plus-Up EA will address two alternatives: the proposed addition of seven F-22 aircraft to the existing F-22 squadrons and the No Action alternative. The Proposed Action under consideration would not require expansion of existing airspace or construction of any new facilities.
2. The Air Force will publish a notice of EA preparation in the Anchorage Daily News, the Mat-Su Valley Frontiersman, and the Eagle River Star.
3. Please return the enclosed postcard by January 6, 2011 to confirm your receipt of this notification, and let us know if you have any general concerns that could be addressed in the upcoming EA. If you believe this proposal will significantly affect any tribal right or protected tribal resource, we invite you to consult with us on a government-to-government basis, in accordance with the Department of Defense *American Indian and Alaska Native Policy* and Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*. Please write to us, or use the enclosed post card, and tell us which tribal rights or protected tribal resources will be affected and how they will be significantly affected. If you would like to consult with us, we will determine times which may be mutually convenient.
4. In order to give your initial comments or concerns consideration early in the development of this EA, I would appreciate receiving your response by January 6, 2011. If you have any specific questions about the proposal, please feel free to contact Ms. Ellen Godden at the above address or at (907) 552-7483. General questions may be directed to Mr. Bob Hall at (907) 552-8152. Thank you for your assistance in this matter.


J. DAVID NORTON, Lt Col, USAF
Commander

Attachments:

1. Distribution List
2. Postcard

F-22 Plus-Up Environmental Assessment
Joint Base Elmendorf-Richardson, Alaska
Alaska Native Villages
EA Memorandum Distribution List

Native Village of Cantwell
ATTN: Veronica Nicholas
P.O. Box 94
Cantwell, AK 99729

Chalkyitsik Village
ATTN: William Salmon, Jr.
PO Box 57
Chalkyitsik, AK 99788

ATTN: Gary Harrison
Chickaloon Native Village
PO Box 1105
Chickaloon, AK 99647

Circle Native Community (IRA)
ATTN: Larry Nathaniel
PO Box 89
Circle, AK 99733

Native Village of Crooked Creek
ATTN: Evelyn Thomas
P.O. Box 69
Crooked Creek, AK 99575

Village of Dot Lake
ATTN: William Miller
PO Box 2279
Dot Lake, AK 99737

Native Village of Eagle (IRA)
ATTN: Conan Goebel
PO Box 19
Eagle, AK 99738

Eklutna Native Village
ATTN: Dorothy Cook
26339 Eklutna Village Road
Chugiak, AK 99567

Gwichyaa Zhee Gwich'in Tribal Govt. (Native
Village of Fort Yukon (IRA))
ATTN: Michael Peter
P.O. Box 126
Fort Yukon, AK 99740-0126

Healy Lake Village
ATTN: JoAnn Polston
PO Box 74090
Fairbanks, AK 99706

Igiugig Village
ATTN: AlexAnna Salmon
P.O. Box 4008
Igiugig, AK 99613-4008

Village of Iliamna
ATTN: Harvey Anelon
P.O. Box 286
Iliamna, AK 99606

Kaltag Tribal Council
ATTN: Donna Esmailka
P.O. Box 129
Kaltag, AK 99748

King Salmon Tribe
ATTN: Ralph Angasan, Sr
P.O. Box 68
King Salmon, AK 99613-0068

Knik Village
ATTN: Debra Call
PO Box 871565
Wasilla, AK 99687

Kokhanok Village
ATTN: John Nelson
P.O. Box 1007
Kokhanok, AK 99606

Lime Village Traditional Council
ATTN: Jennifer John
P.O. Box LVD, Lime Village VIA
McGrath, AK, AK 99627

Louden Tribal Council
ATTN: Chris Sommer
100 Tiger Hwy.
Galena, AK 99741

McGrath Native Village Council
ATTN: Carolyn Vanderpool
P.O. Box 134
McGrath, AK 99627

Naknek Native Village
ATTN: Patrick Peterson, Jr.
P.O. Box 106
Naknek, AK 99633

Nenana Native Association
ATTN: William Lord
P.O. Box 356
Nenana, AK 99760

New Koliganek Village Council
ATTN: Herman Nelson, Sr.
P.O. Box 5057
Koliganek, AK 99576

New Stuyahok Village
ATTN: Evan Wonhda
P.O. Box 49
New Stuyahok, AK 99636

Newhalen Village
ATTN: Raymond Wassillie
P.O. Box 207
Newhalen, AK 99606

Nondalton Village
ATTN: Jack Hobson
P.O. Box 49
Nondalton, AK 99640

Pedro Bay Village Council
ATTN: Keith Jensen
P.O. Box 47020
Pedro Bay, AK 99647

Red Devil Traditional Council
ATTN: Mary Willis
P.O. Box 61
Red Devil, AK 99656

Ruby Tribal Council
ATTN: Patrick McCarty
P.O. Box 210
Ruby, AK 99768

Sleetmute Traditional Council
ATTN: Pete Mellick
P.O. Box 109
Sleetmute, AK 99668

Village of Stony River
ATTN: Mary Willis
P.O. Box SRV
Stony River, AK 99557

Tanacross Village Council
ATTN: Roy Danny
P.O. Box 76009
Tanacross, AK 99776

Native Village of Tanana (IRA)
ATTN: Julia Roberts-Hyslop
P.O. Box 130
Tanana, AK 99777

Native Village of Tyonek
ATTN: Angela Sandstol
PO Box 82009
Tyonek, AK 99682

Native Village of Venetie Tribal Government (IRA)
ATTN: Julian Roberts
P.O. Box 81080
Venetie, AK 99781

Venetie Village Council
ATTN: Mary Gamboa
P.O. Box 81119
Venetie, AK 99781

Evelyn Thomas
Native Village of Crooked Creek
P.O. Box 69
Crooked Creek AK 99575



673 CES/CEAO
Attention: Ms. Ellen Godden
6326 Arctic Warrior Drive
Elmendorf AFB, AK 99506-2850

995063221 C033



F-22

F-22 Plus-Up Environmental Assessment (EA) Joint Base Elmendorf - Richardson



- ☐ We have specific comments on this proposed project and will provide them by **January 6, 2011**.
- ☒ We have brief, general comments, and these include:
We need military Protection & we need
these planes to protect us.
- ☐ We have no comments on the proposed project at this time, but would like to continue to receive information.
- ☐ Please correct the contact information and direct future correspondence to:

FOR PUBLIC RELEASE

Dorothy Cook
Eklutna Native Village
26339 Eklutna Village Road
Chugiak AK 99567



673 CES/CEAO
Attention: Ms. Ellen Godden
6326 Arctic Warrior Drive
Elmendorf AFB, AK 99506-2850

99506#3221 C099



F-22

F-22 Plus-Up Environmental Assessment (EA) Joint Base Elmendorf - Richardson



- ☐ We have specific comments on this proposed project and will provide them by **January 6, 2011**.
- ☐ We have brief, general comments, and these include:
- _____
- _____
- _____
- ☒ We have no comments on the proposed project at this time, but would like to continue to receive information.
- ☐ Please correct the contact information and direct future correspondence to:
- _____
- _____
- _____



Michael Peter
Gwichyaa Zhee Gwich'in Tribal Govt. (Native Village of Fort
Yukon (IRA))
P.O. Box 126
Fort Yukon AK 99740-0126



673 CES/CEAO
Attention: Ms. Ellen Godden
6326 Arctic Warrior Drive
Elmendorf AFB, AK 99506-2850

995062850 C099



F-22

F-22 Plus-Up Environmental Assessment (EA) Joint Base Elmendorf - Richardson



☐ We have specific comments on this proposed project and will provide them by **January 6, 2011**.

☐ We have brief, general comments, and these include:



☒ We have no comments on the proposed project at this time, but would like to continue to receive information.

☐ Please correct the contact information and direct future correspondence to:

AlexAnna Salmon
Igiugig Village
P.O. Box 4008
Igiugig AK 99613-4008



673 CES/CEAO
Attention: Ms. Ellen Godden
6326 Arctic Warrior Drive
Elmendorf AFB, AK 99506-2850

99506-2850 0099



F-22

F-22 Plus-Up Environmental Assessment (EA) Joint Base Elmendorf - Richardson



- ☐ We have specific comments on this proposed project and will provide them by **January 6, 2011**.
- ☐ We have brief, general comments, and these include:
- _____
- _____
- _____
- ☒ We have no comments on the proposed project at this time, but would like to continue to receive information.
- ☐ Please correct the contact information and direct future correspondence to:
- _____
- _____
- _____

Jennifer John
Lime Village Traditional Council
P.O. Box LVD, Lime Village VIA
McGrath, AK AK 99627



673 CES/CEAO
Attention: Ms. Ellen Godden
6326 Arctic Warrior Drive
Elmendorf AFB, AK 99506-2850



F-22

F-22 Plus-Up Environmental Assessment (EA) Joint Base Elmendorf - Richardson



- ☐ We have specific comments on this proposed project and will provide them by **January 6, 2011**.
- ☐ We have brief, general comments, and these include:



We have no comments on the proposed project at this time, but would like to continue to receive information.



Please correct the contact information and direct future correspondence to:

Chris Sommer
Louden Tribal Council
100 Tiger Hwy.
Galena AK 99741



673 CES/CEAO
Attention: Ms. Ellen Godden
6326 Arctic Warrior Drive
Elmendorf AFB, AK 99506-2850

995063221 0099



F-22

F-22 Plus-Up Environmental Assessment (EA) Joint Base Elmendorf - Richardson



- ☐ We have specific comments on this proposed project and will provide them by **January 6, 2011**.
- ☐ We have brief, general comments, and these include:
- _____
- _____
- _____
- ☒ We have no comments on the proposed project at this time, but would like to continue to receive information.
- ☐ Please correct the contact information and direct future correspondence to:
- _____
- _____
- _____

Jack Hobson
Nondalton Village
P.O. Box 49
Nondalton AK 99640



673 CES/CEAO
Attention: Ms. Ellen Godden
6326 Arctic Warrior Drive
Elmendorf AFB, AK 99506-2850



F-22

F-22 Plus-Up Environmental Assessment (EA) Joint Base Elmendorf - Richardson



- ☐ We have specific comments on this proposed project and will provide them by **January 6, 2011**.
- ☐ We have brief, general comments, and these include:
- _____
- _____
- _____
- ☒ We have no comments on the proposed project at this time, but would like to continue to receive information.
- ☐ Please correct the contact information and direct future correspondence to:
- _____
- _____
- _____

Mary Willis
Village of Stony River
P.O. Box SRV
Stony River AK 99557



673 CES/CEAO
Attention: Ms. Ellen Godden
6326 Arctic Warrior Drive
Elmendorf AFB, AK 99506-2850



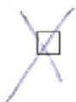
F-22

F-22 Plus-Up Environmental Assessment (EA) Joint Base Elmendorf - Richardson



☐ We have specific comments on this proposed project and will provide them by **January 6, 2011**.

☐ We have brief, general comments, and these include:



☒ We have no comments on the proposed project at this time, but would like to continue to receive information.

☐ Please correct the contact information and direct future correspondence to:

Pete Mellick
Sleetmute Traditional Council
P.O. Box 109
Sleetmute AK 99668



673 CES/CEAO
Attention: Ms. Ellen Godden
6326 Arctic Warrior Drive
Elmendorf AFB, AK 99506-2850

995062850 0000



F-22

F-22 Plus-Up Environmental Assessment (EA) Joint Base Elmendorf - Richardson



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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

AGA Judy
Received

DEC 07 2010

MEMORANDUM FOR U.S. Fish and Wildlife Service
ATTN: Ms. Ann Rappoport
605 W. 45h Ave., Room G61
Anchorage, AK 99501-2250

DEC 2 2010

FROM: 673 CES/CC
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson AK 99506-3240

SUBJECT: F-22 Plus-Up Environmental Assessment

1. The United States Air Force (Air Force) is preparing an F-22 Plus-Up Environmental Assessment (EA) to assess the potential environmental consequences of a proposal to locate 7 additional operational F-22 aircraft at Joint Base Elmendorf-Richardson (JBER). The 2006 F-22A Beddown Environmental Assessment analyzed a proposal of 18 F-15C and 40 F-22 aircraft and assumed an average of 5,500 fighter sorties per year. The current proposal would give JBER 0 F-15C and 47 F-22 aircraft with an estimated annual sortie rate of 4,510 per year, reducing both the total number of fighter aircraft and the estimated sortie rate. The EA will address the proposed action, action alternatives, and a no action alternative.

2. The Air Force began the public scoping period this month and will publish a notice of EA preparation in the Anchorage Daily News and Eagle River Star.

3. Pursuant to analysis of the proposed additional aircraft and to support compliance with the Endangered Species Act, we would like to request information regarding federally listed threatened, endangered candidate, and proposed to be listed species that occur or may occur in the potentially affected area. Please send this information to our primary point of contact at: 673 CES/CEAO, Attn: Ms. Ellen Godden, 6326 Arctic Warrior Drive, Joint Base Elmendorf-Richardson AK 99506-3240. Please provide any preliminary agency comments or information regarding the proposed additional aircraft not later than January 15, 2011 in order to be incorporated in the preparation of the draft EA. Additionally, we would appreciate your identifying a point of contact for any follow-up questions we may have.

4. If you have any specific questions about the proposal, we would like to hear from you. The primary point of contact is Ms. Ellen Godden, (907) 552-7483 and an alternate point of contact is Ms. Valerie Payne, (907) 552-7111. Thank you for your assistance in this matter.

*Called on the 8th of Feb.
Draft EA out on March
Elizabeth Godden@
elmendorf.af.mil*

J. David Norton
J. DAVID NORTON, Lt Col, USAF
Commander

The U.S. Fish and Wildlife Service (USFWS) has reviewed the plans for this proposed project, relative to Section 7(a)(2) of the Endangered Species Act of 1973, as amended (ESA) (16 U.S.C. 1531 et. seq.). Our records indicate that there are no federally listed or proposed species and/or designated or proposed critical habitat within the action area of the proposed project. Therefore, no further action is required regarding the ESA.

If you have further questions regarding this project, please contact our office, U.S. Fish and Wildlife Service, 605 W. 4th Ave., Rm. G-61, Anchorage, AK 99501 Ph: (907) 271-2888, Fax: (907) 271-2786

FWS Log No.

5011-SL-0064

Endangered Species Biologist

Date



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA


12 Oct 10

MEMORANDUM FOR NOAA Fisheries' National Marine Fisheries Service
Protected Resources Division and Habitat Conservation Divisions
Attn: Mr. Brad Smith
222 West 7th Avenue, Box 43
Anchorage, AK 99513

FROM: 673 CES/CC
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson AK 99506-3240

SUBJECT: F-22 Supplemental Environmental Assessment

1. The United States Air Force (Air Force) is preparing a Supplemental Environmental Assessment (EA) to assess the potential environmental consequences of a proposal to locate 7 additional operational F-22 aircraft at Joint Base Elmendorf-Richardson (JBER). The 2006 F-22A Beddown Environmental Assessment analyzed a baseline of 18 F-15C and 40 F-22 aircraft and assumed an average of 5,500 fighter sorties per year. This proposal would give JBER 0 F-15C and 47 F-22 aircraft with an estimated annual sortie rate of 4,510 per year, reducing both the total number of fighter aircraft and the estimated sortie rate. The Supplemental EA will address the proposed action, action alternatives, and a no action alternative.
2. The Air Force will begin the public scoping period later in October or early November and will publish a notice of EA preparation in the Anchorage Daily News and Eagle River Star.
3. Pursuant to analysis of the proposed additional aircraft and to support compliance with the Endangered Species Act, we would like to request information regarding federally listed threatened, endangered candidate, and proposed to be listed species that occur or may occur in the potentially affected area. Please send this information to our primary point of contact at: 673 CES/CEAO, Attn: Ms. Ellen Godden, 6326 Arctic Warrior Drive, Joint Base Elmendorf-Richardson AK 99506-3240. Please provide any preliminary agency comments or information regarding the proposed additional aircraft not later than January 15, 2011 in order to be incorporated in the preparation of the draft EA. Additionally, we would appreciate your identifying a point of contact for any follow-up questions we may have. We would like to meet with your point of contact to discuss how to proceed with this consultation as soon as possible.
4. If you have any specific questions about the proposal, we would like to hear from you. The primary point of contact is Ms. Ellen Godden, (907) 552-7483 and an alternate point of contact is Ms. Valerie Payne, (907) 552-3376. Thank you for your assistance in this matter.


J. DAVID NORTON, Lt Col, USAF
Commander



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
National Marine Fisheries Service
P.O. Box 21668
Juneau, Alaska 99802-1668

November 1, 2010

673 CES/CEAO
Attn: Ms. Ellen Godden
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson, AK
99506-3240

RE: Location of additional aircraft at Joint Base Elmendorf-Richardson (JBER)

Dear Ms. Godden:

The National Marine Fisheries Service (NMFS) has received your Oct. 12, 2010 Memorandum requesting information on threatened or endangered species associated with the addition of 7 operational F-22 aircraft at Joint Base Elmendorf-Richardson (JBER). NMFS offers the following information under the Endangered Species Act (ESA) and the Essential Fish Habitat (EFH) provisions of the Magnuson-Stevens Fishery Conservation Management Act (Magnuson-Stevens Act).

Threatened and Endangered Species

Section 7(a)(2) of the ESA directs Federal interagency cooperation "to insure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered species or threatened species" or result in the destruction or adverse modification of critical habitat. NMFS is responsible for the administration of the ESA as it applies to listed cetaceans, pinnipeds, fish, and reptiles (sea turtles) in Alaska. Further information on NMFS ESA species can be found at:
http://www.nmfs.noaa.gov/pr/species/esa_species.htm.

Endangered Species

NMFS designates those species or distinct stocks of species, which are in jeopardy of extinction as endangered under the ESA. An endangered species is defined in the law as "any species, which is in danger of extinction throughout all or a significant portion of its range." Cook Inlet beluga whales (*Delphinapterus leucus*), which are listed as endangered under the ESA, are frequently sighted in waters adjacent to the project and must be considered when evaluating the effects of the project. Critical habitat for the Cook Inlet beluga is currently being proposed and may require evaluation as well.

Marine/Anadromous Fish

Several ESA-listed stocks of Pacific salmon may occur within Alaska's waters. These include the following Evolutionarily Significant Units (ESU): Snake River fall Chinook (T), Snake River spring/summer Chinook (T), Puget Sound Chinook (T), Upper Columbia River spring Chinook (E), Lower Columbia River Chinook (T), Upper Columbia River steelhead (E), Upper



Willamette River steelhead (T), Middle Columbia River steelhead (T), Lower Columbia River steelhead (T), and Snake River basin steelhead (T). These stocks range throughout the North Pacific. However, the specific occurrence of listed salmonids within the project areas is unlikely.

A detailed stock assessment report providing information (geographic range, a minimum population estimate, current population trends, current and maximum net productivity rates, optimum sustainable population levels and allowable removal levels, and estimates of annual human-caused mortality and serious injury through interactions with commercial fisheries and subsistence hunters) on the marine mammals of Alaska under jurisdiction of NMFS can be found at: <http://www.fakr.noaa.gov/protectedresources/default.htm>. Additional information regarding the ESA is available on our website at: <http://www.nmfs.noaa.gov/pr/laws/esa/>.

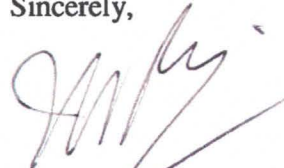
Please be advised that other non-listed marine mammals may also be in the area and are protected under the Marine Mammal Protection Act (MMPA). Information regarding the MMPA may be found at: <http://www.nmfs.noaa.gov/pr/laws/mmpa/>.

Essential Fish Habitat

Under Section 305(b)(2) of the Magnuson-Stevens Act, Federal agencies are required to consult with the Secretary of Commerce on any action that may adversely affect EFH. EFH has been designated in waters used by anadromous salmon and various life stages of marine fish under NMFS' jurisdiction. Five fishery management plans exist for fisheries in Alaska. They cover groundfish in the Gulf of Alaska, groundfish in the Bering Sea and Aleutian Islands, crab in the Bering Sea and Aleutian Islands, and salmon and scallops statewide. Please visit our web site at <http://www.fakr.noaa.gov/habitat> for additional information on habitat and EFH information.

We hope this information is useful in fulfilling your requirements under section 7 of the ESA and section 305(b)(2) of the Magnuson-Stevens Act. Please direct any questions regarding marine mammals or endangered species to Kate Savage at (907) 586-7312 (Kate.Savage@noaa.gov), and questions regarding EFH to Brian Lance at (907) 271-1301 (Brian.Lance@noaa.gov).

Sincerely,



James W. Balsiger, Ph.D.
Administrator, Alaska Region

cc: Brad Smith



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

11 Oct 11

MEMORANDUM FOR NOAA Fisheries' National Marine Fisheries Service
Protected Resources Division and Habitat Conservation Divisions
Attn: Ms. Kate Savage

FROM: 673 CES/CC
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson AK 99506-3240

SUBJECT: Wildlife Analysis for F-22 Supplemental Environmental Assessment

1. The United States Air Force (Air Force) is preparing an F-22 Plus-Up Environmental Assessment (EA) to evaluate the potential environmental consequences of the proposal to add six primary and one back-up F-22 aircraft to the Joint Base Elmendorf-Richardson (JBER) F-22 inventory, an increase in primary aircraft of approximately 17 percent. The purpose of the proposed plus-up is to provide additional Air Force capabilities at a strategic location to meet mission responsibilities for worldwide deployment. Additional F-22 aircraft are needed at JBER to provide U.S. Air Force capability to respond efficiently to national objectives, be available for contingencies, and enhance F-22 operational flexibility.
2. Pursuant to analysis of the proposed additional aircraft and to support compliance with the Endangered Species Act, we initiated an informal consultation in Oct 2010 and received information regarding federally listed threatened, endangered, candidate, and proposed to be listed species that occur or may occur in the potentially affected area from your office on 1 Nov 2010. Having reviewed the provided information, we are pleased to submit the attached Section 7 (Endangered Species Act) Compliance Wildlife Analysis for F-22 Plus-Up Environmental Assessment, Joint Base Elmendorf-Richardson (JBER) Alaska. A determination of "may affect not likely to adversely affect" is found for all species analyzed. We request your concurrence with the "the may affect not likely to adversely affect" determination with regard to species covered by your agency.
3. If you have any specific questions about the wildlife analysis or the proposal, please contact us. The primary point of contact is Ms. Ellen Godden, (907) 552-7483 and an alternate point of contact is Ms. Valerie Payne, (907) 552-3376. Thank you for your assistance in this matter.

J. DAVID NORTON, Lt Col USAF
Commander

Attachment:
Wildlife Analysis



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

National Marine Fisheries Service

P.O. Box 21668

Juneau, Alaska 99802-1668

February 22, 2011

Ms. Ellen Godden
673 CES/CEAOP
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson, AK 99506-3240

Dear Ms. Godden:

The National Marine Fisheries Service (NMFS) has reviewed the "Section 7 (Endangered Species Act) Compliance Wildlife Analysis for F-22 Plus-Up Environmental Assessment" (EA), dated February 11, 2011. In your letter to NMFS, you requested concurrence that the proposed action "may affect, but is not likely to adversely affect", federally listed threatened, endangered or proposed species under NMFS' jurisdiction, including the Cook Inlet Beluga Whale and Western Distinct Population Segment (DPS) of Steller Sea Lion. An agency action is considered not likely to adversely affect listed species or designated critical habitat when its effects are expected to be completely beneficial, discountable, or insignificant. Beneficial effects are synchronous positive effects without any adverse effects to the species or critical habitat. Discountable effects are those extremely unlikely to occur. Insignificant effects relate to the size of the impact and may not reach the scale where take occurs. Based on best judgment, a person would not expect discountable effects to occur; or be able to meaningfully measure, detect or evaluate insignificant effects. The EA also considered project impacts on the five Primary Constituent Elements (PCE) of the proposed Cook Inlet beluga whale critical habitat (74 FR 63095, December 2, 2009) with the determination that the project would not result in adverse modification of the proposed critical habitat.

Summary of EA

The action concerns the addition of six primary and one backup F-22 aircraft to the existing fleet of 36 primary and three backup F-22 aircraft located at Joint Base Elmendorf-Richardson (JBER), Alaska. The increase of the six operational aircraft would increase the number of F-22 sorties by approximately 21 percent. The action area encompasses portions of the Knik Arm that are overflowed by F-22 aircraft on established approach, departure and reentry patterns to the west and north of JBER runways. Two ESA listed species were included in the assessment, the Cook Inlet beluga whale and Steller sea lion.

Regarding Cook Inlet beluga whales (*Delphinapterus leucus*), both individuals and groups are seasonally common in Knik Arm adjacent to JBER. Whales have been noted milling, foraging and socializing in river mouths near Six Mile Creek, North Eagle Bay, Eagle River and Point McKenzie, primarily coincident with the coho salmon run. The



greatest number of whales in Knik Arm has generally been observed between August and November, with the whales tending to move north into Knik Arm with the flooding tide, usually within one mile of the eastern shore, and move south out of Knik Arm on the ebbing tide, usually within one mile of the western shore. In or adjacent to JBER, whales have been observed in Eagle Bay and also occasionally feeding at the mouth of Six Mile Creek. Although up to 71 whales have been seen in Eagle Bay during a single summer observation, the average daily visits to the area included nine whales.

The EA then assessed impacts of the action on the Cook Inlet beluga whale, which include acoustic and visual disturbance. Because acoustic disturbance is the predominant impact of the action, the sound profile of the additional F-22's was evaluated in relation to the five major categories of acoustic effect, including 1. Direct trauma; 2. Auditory fatigue; 3. Auditory masking; 4. Stress response; and 5. Behavioral reactions. Neither direct trauma nor auditory fatigue was a predicted outcome of the action based on the level and duration of the modeled F-22 sound profile. The maximum sound pressure level of an F-22 overflight within water was calculated at 137 dB re 1 μ Pa for a duration of a few seconds, which was not considered sufficiently intense or long-lasting to result in direct trauma or auditory fatigue. Auditory masking was not expected because the F-22 overflight noise levels are close enough to ambient noise, which normally exceeds 120 dB re 1 μ Pa in the area, and are of very short duration. Regarding stress response and behavioral reactions, an analytical model was used to quantify potential behavioral disturbances based on predicted sound levels, animal threshold reactions to similar sounds and Cook Inlet beluga whale density. Based upon the results of all flight profiles, the number of behavioral reactions was conservatively estimated at less than 0.04 individuals per year. Additional factors for consideration included the possibility of habituation, the sound frequency of jet engines being predominantly lower than the best hearing range of belugas, the very brief duration of exposure and high ambient noise levels in the area. The likelihood of behavioral reaction was summarized as discountable. Potential visual impacts were considered minimal because of the flight altitude (weighted average of closest approach to water was 2,250 feet MSL for all flight paths), small size of the aircraft and rapidity of flight. Based on the acoustic and visual impact assessments, it was concluded that the project may affect, but is not likely to adversely affect the Cook Inlet beluga whale.

Project effects were also analyzed relative to the five Primary Constituent Elements of the proposed Cook Inlet beluga whale critical habitat. No effects were expected on water quality or hydrology, prey species or beluga whale passage within or between critical habitat, no introduction of toxins or harmful substances was expected and in water noise levels were not expected to result in the abandonment of habitat. It was concluded that the project would not result in adverse modification of the proposed critical habitat of the Cook Inlet beluga whale.

Regarding Steller sea lions (*Eumetopias jubatus*), the presence of the species is considered very rare in Knik Arm and the EA included the sighting of a single animal in 2009. With respect to potential impacts on Steller sea lions, the EA determined that, because the species does not normally occur in the action area, the combined likelihood

of an occurrence and elevated F-22 noise event is discountable. Therefore, the action may affect, but is not likely to adversely affect the Western DPS of Steller sea lion.

Discussion

A. Cook Inlet Beluga Whale

The Cook Inlet beluga stock has probably always numbered fewer than several thousand animals, but has declined significantly from its historical abundance. In 1979, the Cook Inlet beluga stock was estimated at 1300 animals (Calkins 1989), which subsequently decreased to 653 animals in 1994 and to an estimated 340 in 2010 (NMFS 2010).

Beluga whales use sound rather than sight for many important functions, including communication, prey location and navigation. In Cook Inlet, beluga whales must compete acoustically with natural and anthropogenic sounds. Man-made sources of noise in Cook Inlet include large and small vessels, aircraft, oil and gas drilling, marine seismic surveys, pile driving, and dredging. The effects of man-made noise on beluga whales depend on several factors including the intensity, frequency and duration of the noise, the location and behavior of the whale, and the acoustic nature of the environment. High frequency noise diminishes more rapidly than lower frequency noises. Sound also dissipates more rapidly in shallow waters and over soft bottoms (sand and mud). Much of upper Cook Inlet is characterized by its shallow depth, sand/mud bottoms, and high background noise from currents and glacial silt (Blackwell and Greene 2002) thereby making it a poor acoustic environment.

Anthropogenic noise above ambient levels and within the same frequencies used by belugas may mask communication between these animals. At louder levels, noise may result in disturbance and harassment, or cause temporary or permanent damage to the whales' hearing. Although captive beluga whales have provided some insight into beluga hearing and the levels of noise that might damage their hearing capabilities, much less information is available on how noise might impact beluga whales behaviorally in the wild. In the Canadian high Arctic, beluga whales were observed to react to ice-breaking ships at distances of more than 80 km, showing strong avoidance, apparent alarm calls, and displacement (Finley et al. 1990). However, in less pristine, more heavily trafficked areas belugas may habituate to vessel noise.

Beluga whales have a well-developed sense of hearing and echolocation. These whales hear over a large range of frequencies, from about 40-75 Hertz (Hz) to 30-100 kiloHertz (kHz) (Richardson 1995), although their hearing is most acute at relatively high frequencies, between 10 and 100 kHz (Blackwell and Greene 2002), which is generally above the level of much industrial noise. The beluga whales' hearing falls off rapidly above 100 kHz. However, beluga whales may hear sounds as low as 40-75 Hz, although this noise would have to be very loud. Jet aircraft noise is most intense in relatively low frequency bands, primarily below 4 kHz.

Cook Inlet experiences significant levels of aircraft traffic. The Anchorage International Airport is directly adjacent to lower Knik Arm and has high volumes of commercial and

cargo air traffic. Lake Hood and Spenard Lake in Anchorage are also heavily used by recreational seaplanes. Even though sound is attenuated by water surface, Blackwell and Green (2002) found that aircraft noise can be quite loud underwater when jet aircraft are directly overhead. Belugas may be less sensitive to aircraft noise than vessel noise, but individual responses may be highly variable and depend on the beluga's previous experiences, its activity at the time of the noise, and the characteristics of the noise. The area around lower Knik Arm, including the Port of Anchorage, is typically characterized by high levels of ambient noise. The EA cites levels as high as 143 re 1 μ Pa on shipping days for the Port of Anchorage and background levels rarely below 125 dB re 1 μ Pa. NMFS considers the Level A in-water harassment threshold to be 180 dB re 1 μ Pa for cetaceans. Level B harassment from pulsed noise is 160 dB re 1 μ Pa and 125 dB re 1 μ Pa from non-pulsed noise. Of the seven flight paths assessed, sound pressure levels (SPL) ranged from 117.3 to 137 dB re 1 μ Pa. The number of additional events at the maximum SPL was approximately 1.5 per day. Given the high ambient noise in the area, the low number of additional daily events which would be complete in a matter of seconds and the low probability of animals within the path of maximum SPL, the likelihood of behavioral change due to the additional F-22s is insignificant.

Beluga whales may also respond to visual disturbance. In the Beaufort Sea, belugas were observed diving or swimming away when low-flying (<500 m) aircraft passed directly over them (Richardson 1995). However, in Cook Inlet little or no change was noted in beluga swim direction with small aircraft flying at approximately 800 ft, which was considered most likely due to beluga habituation to routine, small aircraft overflights (Rugh et al. 2000). As the weighted closest approach of all F-22 flight paths is 2,250 feet, the likelihood of visual disturbance from the F-22 aircraft is insignificant.

With the exception of the in-water acoustic impacts as addressed above, the action does not include marine components and will, therefore, not affect the PCEs for proposed critical habitat. NMFS agrees that the project will not result in adverse modification of proposed critical habitat of the Cook Inlet beluga whale.

In summary, NMFS concurs with the determination that the proposed action may affect, but is not likely to adversely affect, the population of Cook Inlet beluga whales as well as the determination that the action will not cause adverse modification to proposed critical habitat.

B. Steller sea lions

The Western DPS of Steller sea lion inhabit much of Alaskan coastal waters west of 144°. Within this area, sea lions may traverse and forage over great distances, moving onto terrestrial haulout sites for rest, molting and predator avoidance and seasonal rookery sites for reproductive activities. Critical habitat for Steller sea lions has been designated based on the spatial extent of foraging, prey location and on the location of terrestrial haulout and rookery sites (NMFS 2008). Upper Cook Inlet, including Knik Arm, does not support any Steller sea lion rookeries, haulouts or critical habitat. The species is rarely found there, with the Forelands generally considered the most northerly limit of Steller sea lion range in Cook Inlet (M. Migura, personal communication, NMFS). NMFS agrees

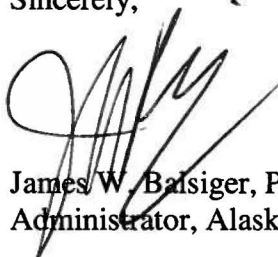
that the combined likelihood of Steller sea lion presence in the action area and F-22 overflight exposure is discountable and that the action may affect, but is not likely to adversely affect, the western DPS of Steller sea lion.

Conclusion

NMFS concurs with your agency's determination that the planned action may affect, but is not likely to adversely affect, ESA-listed species or designated critical habitat under NMFS jurisdiction, including Cook Inlet beluga whale and the western population of Steller sea lion. NMFS also concurs that the action will not result in adverse modification of proposed critical habitat for the Cook Inlet beluga whale.

Re-initiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) take of a listed species occurs, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered, (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered, or (4) a new species is listed or critical habitat designated that may be affected by the action. Should any questions or concerns arise, please contact Kate Savage at *Kate.Savage@noaa.gov*.

Sincerely,

A handwritten signature in black ink, appearing to read 'JBalsiger', is written over the typed name and title.

James W. Balsiger, Ph.D.
Administrator, Alaska Region

Cc: Brad Smith

List of References

Blackwell, S.B. and C.R. Greene, Jr. 2002. Acoustic measurements in Cook Inlet, Alaska, during 2001. Report from Greeneridge Sciences, Inc., Aptos, CA, for NMFS, Anchorage, AK.

Calkins, D.G. 1989. Status of Belukha whales in Cook Inlet. In: Gulf of Alaska, Cook Inlet and North Aleutian Basin information update meeting. L. E. Jarvela and L. Thorsteinson (eds.). Anchorage, AK., Feb 7-8, 1989. Anchorage, AK.: USDOC, NOAA,OCSEAP, p 109-112.

Finley, K.J., G.W. Miller, R.A. Davis, and C.R. Greene. 1990. Reactions of belugas, *Delphinapterus leucas*, and narwhals, *Monodon monoceros*, to ice-breaking ships in the Canadian high Arctic. Canadian Bulletin of Fisheries and Aquatic Sciences 224: 97-117.

NMFS (National Marine Fisheries Service). 2010. Cook Inlet beluga population up since 2009; Overall trend still downward. NOAA Fisheries release, October 8, 2010. Accessed Oct. 12, 2010 at: <http://www.fakr.noaa.gov/newsreleases/2010/belugapopulation.htm>.

NMFS (National Marine Fisheries Service). 2008. Recovery Plan for the Steller Sea Lion, Eastern and Western Distinct Population Segments (*Eumetopias jubatus*), Revision. National Marine Fisheries Service, Juneau, Alaska. 325 pp.

Richardson, W. J., Greene, C. R., Jr., Koski, W. R., Malme, C. I., Miller, G. W., Smultea, M. A., et al. 1990. Acoustic effects of oil production activities on bowhead and white whales visible during spring migration near Pt. Barrow, Alaska—1989 phase (OCS Study MMS 90- 0017; NTIS PB91-105486). LGL Ltd. report for U.S. Minerals Management Service, Herndon, VA. 284 pp.

Rugh, D., Shelden, K. and B. Mahoney. 2000. Distribution of beluga whales in Cook Inlet, Alaska, during June/July 1993 to 1999. Mar. Fish. Rev. 62 (3): 6 -21.



**DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA**

12 April 2011

MEMORANDUM FOR ALASKA DEPARTMENT OF NATURAL RESOURCES
OFFICE OF HISTORY AND ARCHAEOLOGY
ATTENTION: MS. JUDITH E. BITTNER

FROM: 673 CES/CC
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson AK 99506-3240

SUBJECT: Statement of "No Adverse Effect" for Proposed Project

1. The 673d Air Base Wing (ABW) and the United States Air Force (USAF) are pleased to provide you a copy of the Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI) for the proposed addition (plus-up) of seven F-22 aircraft to the Joint Base Elmendorf-Richardson (JBER) current inventory of 40 F-22 aircraft. The additional aircraft would train in existing Alaska airspace and would not require construction of any new facilities, or renovation of existing facilities.
2. As a federal undertaking, this project is subject to 36 Code of Federal Regulations (CFR) Part 800, the regulations implementing Section 106 of the National Historic Preservation Act (16 U.S. Code [USC] Section 470f); with this letter the 673d ABW is initiating consultation regarding the proposed F-22 plus-up.
3. Twenty-seven archaeological sites have been located at JBER. Twenty sites are recommended as ineligible for the NRHP, five are unevaluated, and two are considered eligible. There are 54 NRHP eligible buildings or structures on JBER-Elmendorf, most of which are located in one of three historic districts: the Flightline Historic District; the Alaska Air Depot Historic District; and the Generals' Quad Historic District. Other historic-eligible structures at JBER-Richardson include Buildings 1 and 3, along with those associated with the Nike Site Summit Historic District.
4. There would be no adverse effects to archaeological resources or NRHP-eligible architectural resources from the proposed undertaking, as there would be no construction of any new facilities, or renovation of existing facilities. There would be no adverse effects to historic buildings resulting from the small increase in noise associated with the plus-up since their NRHP eligibility is based, in part, on their association with an active Air Force installation at which jet aircraft routinely operate resulting in an elevated noise environment.

5. There would be no adverse effects to historic properties under the airspace as a result of the proposed F-22 plus-up. An increase in sonic booms, when discernible, may annoy users of land, but would not be expected to affect Alaska Native subsistence hunting.

6. Also in accordance with 36 CFR Part 800.2, the 673d ABW is seeking to include interested Alaska Native villages or Tribal governments. Notices of the intent to prepare the EA with enclosed stamped return postcards were sent to 35 Alaska Native villages and Tribal government entities. Nine Alaska Native villages returned the response postcards. No specific comments on the proposed F-22 plus-up from any Alaska Native village or Tribal government entity have been received to date.

7. Pursuant to 36 CFR Part 800.5 (b), we have determined that this undertaking will have "no adverse effect" on historic properties. We invite you to review the attached EA, and respectfully request your office concur with this determination as completion of our Section 106 consultation requirements under the National Historic Preservation Act.

8. If you have any questions, please contact Mr. Jon Scudder, 3 CES/CEAN, at 552-4157.


J. DAVID NORTON, Lt Col, USAF
Commander

Attachments:

1. Environmental Assessment
2. Distribution List

F-22 Plus-Up Environmental Assessment
Joint Base Elmendorf-Richardson, Alaska
Agency Coordination
EA Memorandum Distribution List

Federal Aviation Administration, Alaska Region
ATTN: Bob Lewis
222 West 7th Ave. #14
Anchorage, AK 99513

U.S. Department of Agriculture
ATTN: Robert Jones
Natural Resources Conservation Service
800 W. Evergreen Ave., Suite 100
Palmer, AK 99545-6539

U.S. Department of Interior
ATTN: Pamela Bergmann
Office of Environmental Policy
1689 C Street, Rm. 119
Anchorage, AK 99501

U.S. Department of Transportation
ATTN: David Miller
Federal Highway Administration
P.O. Box 21648
Juneau, AK 99802-1648

U.S. Department of Transportation
ATTN: Robert Bouchard
Maritime Administration
1200 New Jersey Ave., SE (mar-510,#w21-224
Washington, DC 20590

U.S. Department of Interior
ATTN: Edward Parisian
Bureau of Indian Affairs, Alaska Regional Office
P.O. Box 25520
Juneau, AK 99802

U.S. Department of Transportation
ATTN: Richard Krochalis
Federal Transit Administration, Regional 10
915 Second Ave., Ste. 3142
Seattle, WA 98174-1002

U.S. Fish and Wildlife Service
ATTN: Ann Rappoport
Anchorage Fish & Wildlife Field Office
605 4th Ave., Rm. G-61
Anchorage, AK 99501

United States Coast Guard
ATTN: CAPT Jason Fosdick
Sector Anchorage
510 L Street, Ste. 100
Anchorage, AK 99501

National Marine Fisheries Service
ATTN: Brad Smith
Protected Resources Div/Habitat Consv
222 W. 7th Avenue, Rm. 517
Anchorage, AK 99513

National Park Service
ATTN: Sue Masica
Alaska Regional Office
240 W 5th Avenue, Room 114
Anchorage, AK 99501

Bureau of Land Management
ATTN: Gary Reimer
Anchorage District Office
4700 BLM Rd.
Anchorage, AK 99507

U.S. Environmental Protection Agency, Region 10
ATTN: Jacques Gusmano
222 West 7th Ave.
Room 537
Anchorage, AK 99513-7588

Alaska Department of Environmental Conservation
ATTN: Deb Caillouet
555 Cordova
Anchorage, AK 99501

Alaska Department of Fish and Game
ATTN: Mark Burch
Division of Wildlife Conservation
333 Raspberry Rd.
Anchorage, AK 99518-1599

Alaska Department of Military and Veterans Affairs
ATTN: MAJ GEN Thomas Katkus
PO Box 5800
Camp Denali
JBER, AK 99505

Alaska Department of Natural Resources
ATTN: Thomas Irwin
Office of the Commissioner
550 W. 7th Avenue, Suite 1400
Anchorage, AK 99501

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ATTN: James King
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Anchorage, AK 99501-3561

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Central Region
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Anchorage, AK 99501

Alaska Railroad Corporation
ATTN: Christopher Aadnesen
P.O. Box 107500
Anchorage, AK 99510

Ted Stevens Anchorage International Airport
ATTN: John Parrot
PO Box 196960
Anchorage, AK 99519

Anchorage Assembly
ATTN: Barbara Gruenstein
P.O. Box 196650
Anchorage, AK 99519

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Anchorage, AK 99514

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ATTN: Michael Anderson
2111 Rayburn House Office Building
Washington, DC 20515-0201

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ATTN: Chad Padgett
510 L Street
Suite 580
Anchorage, AK 99501

Senator Mark Begich
ATTN: Susanne Fleek
510 L Street
Suite 750
Anchorage, AK 99501

Senator Mark Begich
ATTN: David Ramseur
144 Russell Senate Office Building
Washington, DC 20510

Senator Lisa Murkowski
ATTN: Karen Knutson
709 Hart Senate Office Building
Washington, DC 20510-0202

Senator Lisa Murkowski
ATTN: Kevin Sweeney
510 L Street
Suite 550
Anchorage, AK 99501

State of Alaska
ATTN: Sean Parnell
PO Box 110001
Juneau, AK 99811-0001

Alaska Resources Library and Information Services
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Anchorage, AK 99508

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Alaska Native Villages
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Village of Fort Yukon (IRA))
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P.O. Box 126
Fort Yukon, AK 99740-0126

Healy Lake Village
ATTN: JoAnn Polston
PO Box 74090
Fairbanks, AK 99706

Igiugig Village
ATTN: AlexAnna Salmon
P.O. Box 4008
Igiugig, AK 99613-4008

Village of Iliamna
ATTN: Harvey Anelon
P.O. Box 286
Iliamna, AK 99606

Kaltag Tribal Council
ATTN: Donna Esmailka
P.O. Box 129
Kaltag, AK 99748

King Salmon Tribe
ATTN: Ralph Angasan, Sr
P.O. Box 68
King Salmon, AK 99613-0068

Knik Village
ATTN: Debra Call
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Wasilla, AK 99687

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ATTN: Chris Sommer
100 Tiger Hwy.
Galena, AK 99741

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Nenana, AK 99760

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Koliganek, AK 99576

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Newhalen Village
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Nondalton, AK 99640

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P.O. Box 47020
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P.O. Box 61
Red Devil, AK 99656

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ATTN: Patrick McCarty
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Ruby, AK 99768

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Venetie, AK 99781

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Venetie, AK 99781



**DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA**

12 April 2011

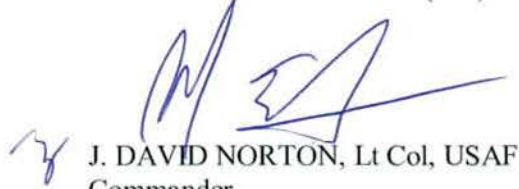
MEMORANDUM FOR SEE DISTRIBUTION

FROM: 673 CES/CC
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson AK 99506-3240

SUBJECT: Environmental Assessment for the Plus-Up of Seven Additional F-22 Aircraft at Joint Base Elmendorf-Richardson, Alaska

1. The 673d Air Base Wing (ABW) and the United States Air Force (USAF) are pleased to provide you a copy of the Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI) for the proposed addition (plus-up) of seven F-22 aircraft to the Joint Base Elmendorf-Richardson (JBER) current inventory of 40 F-22 aircraft. The additional aircraft would train in existing Alaska airspace and would not require construction of any new facilities.
2. You are invited to provide comments on the proposed action by mail, postmarked no later than May 12, 2011, to ensure proper consideration in the preparation of the EA. Please send any comments to:

Mr. Bob Hall
673 ABW/PA
10480 22nd St.
Joint Base Elmendorf-Richardson AK 99506-3240
3. Written comments received by the Air Force will be considered in the preparation of the EA and will be made a part of the administrative record. Thank you for your participation.
4. Please direct any written comments or requests for information to Mr. Bob Hall at (907) 552-8152.


J. DAVID NORTON, Lt Col, USAF
Commander

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2111 Rayburn House Office Building
Washington, DC 20515-0201

Congressman Don Young
ATTN: Chad Padgett
510 L Street
Suite 580
Anchorage, AK 99501

Senator Mark Begich
ATTN: Susanne Fleek
510 L Street
Suite 750
Anchorage, AK 99501

Senator Mark Begich
ATTN: David Ramseur
144 Russell Senate Office Building
Washington, DC 20510

Senator Lisa Murkowski
ATTN: Karen Knutson
709 Hart Senate Office Building
Washington, DC 20510-0202

Senator Lisa Murkowski
ATTN: Kevin Sweeney
510 L Street
Suite 550
Anchorage, AK 99501

State of Alaska
ATTN: Sean Parnell
PO Box 110001
Juneau, AK 99811-0001

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ATTN: AlexAnna Salmon
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Igiugig, AK 99613-4008

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ATTN: Harvey Anelon
P.O. Box 286
Iliamna, AK 99606

Kaltag Tribal Council
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Kaltag, AK 99748

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King Salmon, AK 99613-0068

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ATTN: Mary Willis
P.O. Box 61
Red Devil, AK 99656

Ruby Tribal Council
ATTN: Patrick McCarty
P.O. Box 210
Ruby, AK 99768

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Sleetmute, AK 99668

Village of Stony River
ATTN: Mary Willis
P.O. Box SRV
Stony River, AK 99557

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P.O. Box 81080
Venetie, AK 99781

Venetie Village Council
ATTN: Mary Gamboa
P.O. Box 81119
Venetie, AK 99781

From: [Godden, Elizabeth E Civ USAF PACAF 673 CES/CEANR](#)
To: [Jimenez, Joseph A.](#); [Van Tassel, Robert E.](#)
Subject: FW: F-22 Plus-Up Environmental Assessment JBER EA
Date: Monday, April 11, 2011 12:42:09 PM

FYI

-----Original Message-----

From: Howard, Louis R (DEC) [<mailto:louis.howard@alaska.gov>]
Sent: Monday, April 11, 2011 12:36 PM
To: Godden, Elizabeth E Civ USAF PACAF 673 CES/CEANR
Cc: gusmano.jacques@epa.gov
Subject: F-22 Plus-Up Environmental Assessment JBER EA

ADEC has no comments nor any objections to the Proposed Action to augment the existing F-22 operational wing at JBER with six primary aircraft and one backup aircraft; to conduct flying sorties at the base and in existing Alaskan airspace for training and deployment; and implement personnel changes to conform to the F-22 Wing requirements.

Louis Howard

State of Alaska

Dept. of Environmental Conservation

Contaminated Sites Program

Federal Facilities Environmental Restoration

555 Cordova St 2nd fl.

Anchorage AK 99501-2617

Phone: (907) 269-7552

Facsimile: (907) 269-7649

louis.howard@alaska.gov



DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

12 April 2011

MEMORANDUM FOR SLEETMUTE TRADITIONAL COUNCIL
ATTENTION: PETE MELICK

FROM: 673 CES/CC
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson AK 99506-3240

SUBJECT: Environmental Assessment for the Plus-Up of Seven Additional F-22 Aircraft at Joint Base Elmendorf-Richardson, Alaska

1. The 673d Air Base Wing (ABW) and the United States Air Force (USAF) are pleased to provide you a copy of the Environmental Assessment (EA) and Draft Finding of No Significant Impact (FONSI) for the proposed addition (plus-up) of seven F-22 aircraft to the Joint Base Elmendorf-Richardson (JBER) current inventory of 40 F-22 aircraft. The additional aircraft would train in existing Alaska airspace and would not require construction of any new facilities.


2. We received your response post card to our scoping process in December, 2010 with the comment that you had specific comments on the proposed project, but we did not receive your comments in January, 2011. We invite you to share them with us during this final comment period.

2. You are invited to provide comments on the proposed action by mail, postmarked no later than May 12, 2011, to ensure proper consideration in the preparation of the EA. Please send any comments to:

Mr. Bob Hall
673 ABW/PA
10480 22nd St.
Joint Base Elmendorf-Richardson AK 99506-3240

3. Written comments received by the Air Force will be considered in the preparation of the EA and will be made a part of the administrative record. Thank you for your participation.

4. Please direct any written comments or requests for information to Mr. Bob Hall at (907) 552-8152.


J. DAVID NORTON, Lt Col, USAF
Commander

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U.S. Department of Agriculture
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F-22 Plus-Up Environmental Assessment
Joint Base Elmendorf-Richardson, Alaska
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F-22 Plus-Up Environmental Assessment and signed Finding of No Significant Impact Distribution

The F-22 Plus-Up Environmental Assessment, Joint Base Elmendorf-Richardson, Alaska and signed Finding of No Significant Impact were distributed in July 2011 to the same agencies and organizations that received the 12 April 2011 Environmental Assessment and Draft Finding of No Significant Impact.

Appendix D

Aircraft Noise Analysis and Airspace Operations

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APPENDIX D AIRCRAFT NOISE ANALYSIS AND AIRSPACE OPERATIONS

Noise is generally described as unwanted sound. Unwanted sound can be based on objective effects (such as hearing loss or damage to structures) or subjective judgments (community annoyance). Noise analysis thus requires a combination of physical measurement of sound, physical and physiological effects, plus psycho- and socio-acoustic effects.

Section 1.0 of this appendix describes how sound is measured and summarizes noise impact in terms of community acceptability and land use compatibility. Section 2.0 gives detailed descriptions of the effects of noise that lead to the impact guidelines presented in section 1. Section 3.0 provides a description of the specific methods used to predict aircraft noise, including a detailed description of sonic booms.

D1 Noise Descriptors and Impact

Aircraft operating in the Military Operations Areas (MOAs) and Warning Areas generate two types of sound. One is “subsonic” noise, which is continuous sound generated by the aircraft’s engines and also by air flowing over the aircraft itself. The other is sonic booms (only in MOAs and Warning Areas authorized for supersonic), which are transient impulsive sounds generated during supersonic flight. These are quantified in different ways.

Section 1.1 describes the characteristics which are used to describe sound. Section 1.2 describes the specific noise metrics used for noise impact analysis. Section 1.3 describes how environmental impact and land use compatibility are judged in terms of these quantities.

D1.1 Quantifying Sound

Measurement and perception of sound involve two basic physical characteristics: amplitude and frequency. Amplitude is a measure of the strength of the sound and is directly measured in terms of the pressure of a sound wave. Because sound pressure varies in time, various types of pressure averages are usually used. Frequency, commonly perceived as pitch, is the number of times per second the sound causes air molecules to oscillate. Frequency is measured in units of cycles per second, or hertz (Hz).

Amplitude. The loudest sounds the human ear can comfortably hear have acoustic energy one trillion times the acoustic energy of sounds the ear can barely detect. Because of this vast range, attempts to represent sound amplitude by pressure are generally unwieldy. Sound is, therefore, usually represented on a logarithmic scale with a unit called the decibel (dB). Sound on the decibel scale is referred to as a sound level. The threshold of human hearing is approximately 0 dB, and the threshold of discomfort or pain is around 120 dB.

Because of the logarithmic nature of the decibel scale, sounds levels do not add and subtract directly and are somewhat cumbersome to handle mathematically. However, some simple

rules of thumb are useful in dealing with sound levels. First, if a sound's intensity is doubled, the sound level increases by 3 dB, regardless of the initial sound level. Thus, for example:

$$60 \text{ dB} + 60 \text{ dB} = 63 \text{ dB, and}$$

$$80 \text{ dB} + 80 \text{ dB} = 83 \text{ dB.}$$

The total sound level produced by two sounds of different levels is usually only slightly more than the higher of the two. For example:

$$60.0 \text{ dB} + 70.0 \text{ dB} = 70.4 \text{ dB.}$$

Because the addition of sound levels behaves differently than that of ordinary numbers, such addition is often referred to as "decibel addition" or "energy addition." The latter term arises from the fact that combination of decibel values consists of first converting each decibel value to its corresponding acoustic energy, then adding the energies using the normal rules of addition, and finally converting the total energy back to its decibel equivalent.

The difference in dB between two sounds represents the ratio of the amplitudes of those two sounds. Because human senses tend to be proportional (i.e., detect whether one sound is twice as big as another) rather than absolute (i.e., detect whether one sound is a given number of pressure units bigger than another), the decibel scale correlates well with human response.

Under laboratory conditions, differences in sound level of 1 dB can be detected by the human ear. In the community, the smallest change in average noise level that can be detected is about 3 dB. A change in sound level of about 10 dB is usually perceived by the average person as a doubling (or halving) of the sound's loudness, and this relation holds true for loud sounds and for quieter sounds. A decrease in sound level of 10 dB actually represents a 90 percent decrease in sound *intensity* but only a 50 percent decrease in perceived *loudness* because of the nonlinear response of the human ear (similar to most human senses).

The one exception to the exclusive use of levels, rather than physical pressure units, to quantify sound is in the case of sonic booms. As described in Section 3, sonic booms are coherent waves with specific characteristics. There is a long-standing tradition of describing individual sonic booms by the amplitude of the shock waves, in pounds per square foot (psf). This is particularly relevant when assessing structural effects as opposed to loudness or cumulative community response. In this study, sonic booms are quantified by either dB or psf, as appropriate for the particular impact being assessed.

Frequency. The normal human ear can hear frequencies from about 20 Hz to about 20,000 Hz. It is most sensitive to sounds in the 1,000 to 4,000 Hz range. When measuring community response to noise, it is common to adjust the frequency content of the measured sound to correspond to the frequency sensitivity of the human ear. This adjustment is called A-weighting (American National Standards Institute 1988). Sound levels that have been so adjusted are referred to as A-weighted sound levels.

The spectral content of the F-22A is somewhat different than other aircraft, including (at high throttle settings) the characteristic nonlinear crackle of high thrust engines. The spectral

characteristics of various noises are accounted for by A-weighting, which approximates the response of the human ear. There are other, more detailed, weighting factors that have been applied to sounds. In the 1950s and 1960s, when noise from civilian jet aircraft became an issue, substantial research was performed to determine what characteristics of jet noise were a problem. The metrics Perceived Noise Level and Effective Perceived Noise Level were developed. These accounted for nonlinear behavior of hearing and the importance of low frequencies at high levels, and for many years airport/airbase noise contours were presented in terms of Noise Exposure Forecast, which was based on Perceived Noise Level and Effective Perceived Noise Level. In the 1970s, however, it was realized that the primary intrusive aspect of aircraft noise was the high noise level, a factor which is well represented by A-weighted levels and L_{dn} . The refinement of Perceived Noise Level, Effective Perceived Noise Level, and Noise Exposure Forecast was not significant in protecting the public from noise.

There has been continuing research on noise metrics and the importance of sound quality, sponsored by the Department of Defense (DoD) for military aircraft noise and by the Federal Aviation Administration (FAA) for civil aircraft noise. The metric L_{dnmr} , which accounts for the increased annoyance of rapid onset rate of sound, is a product of this long-term research. DoD is sponsoring the development of NoiseRunner, which will calculate noise in a more sophisticated manner than done by NOISEMAP and MR_NMAP. At the present time, however, NOISEMAP and MR_NMAP, and the metrics L_{dn} and L_{dnmr} , represent the best current science for analysis of military aircraft.

The amplitude of A-weighted sound levels is measured in dB. It is common for some noise analysts to denote the unit of A-weighted sounds by dBA. As long as the use of A-weighting is understood, there is no difference between dB or dBA: it is only important that the use of A-weighting be made clear. In this Environmental Assessment (EA), sound levels are reported in dB and are A-weighted unless otherwise specified.

A-weighting is appropriate for continuous sounds, which are perceived by the ear. Impulsive sounds, such as sonic booms, are perceived by more than just the ear. When experienced indoors, there can be secondary noise from rattling of the building. Vibrations may also be felt. C-weighting (American National Standards Institute 1988) is applied to such sounds. This is a frequency weighting that is flat over the range of human hearing (about 20 Hz to 20,000 Hz) and rolls off above and below that range. In this study, C-weighted sound levels are used for the assessment of sonic booms and other impulsive sounds. As with A-weighting, the unit is dB, but dBC is sometimes used for clarity. In this study, sound levels are reported in dB, and C-weighting is specified as necessary.

Time Averaging. Sound pressure of a continuous sound varies greatly with time, so it is customary to deal with sound levels that represent averages over time. Levels presented as instantaneous (i.e., as might be read from the dial of a sound level meter) are based on averages of sound energy over either 1/8 second (fast) or 1 second (slow). The formal definitions of fast and slow levels are somewhat complex, with details that are important to the makers and users of instrumentation. They may, however, be thought of as levels corresponding to the root-mean-square sound pressure measured over the 1/8-second or 1-second periods.

The most common uses of the fast or slow sound level in environmental analysis is in the discussion of the maximum sound level that occurs from the action, and in discussions of typical sound levels. Figure D-1 is a chart of A-weighted sound levels from typical sounds. Some (air conditioner, vacuum cleaner) are continuous sounds whose levels are constant for some time. Some (automobile, heavy truck) are the maximum sound during a vehicle passby. Some (urban daytime, urban nighttime) are averages over some extended period. A variety of noise metrics have been developed to describe noise over different time periods. These are described in section 1.2.

D1.1 Noise Metrics

D1.1.1 Maximum Sound Level

The highest A-weighted sound level measured during a single event in which the sound level changes value as time goes on (e.g., an aircraft overflight) is called the maximum A-weighted sound level or maximum sound level, for short. It is usually abbreviated by ALM, L_{\max} , or $L_{A\max}$. The maximum sound level is important in judging the interference caused by a noise event with conversation, TV or radio listening, sleeping, or other common activities.

D1.1.2 Peak Sound Level

For impulsive sounds, the true instantaneous sound pressure is of interest. For sonic booms, this is the peak pressure of the shock wave, as described in section 3.2 of this appendix. This pressure is usually presented in physical units of pounds per square foot. Sometimes it is represented on the decibel scale, with symbol L_{pk} . Peak sound levels do not use either A or C weighting.

D1.1.3 Sound Exposure Level

Individual time-varying noise events have two main characteristics: a sound level that changes throughout the event and a period of time during which the event is heard. Although the maximum sound level, described above, provides some measure of the intrusiveness of the event, it alone does not completely describe the total event. The period of time during which the sound is heard is also significant. The Sound Exposure Level (abbreviated SEL or L_{AE} for A-weighted sounds) combines both of these characteristics into a single metric.

SEL is a composite metric that represents both the intensity of a sound and its duration. Mathematically, the mean square sound pressure is computed over the duration of the event, then multiplied by the duration in seconds, and the resultant product is turned into a sound level. It does not directly represent the sound level heard at any given time, but rather provides a measure of the net impact of the entire acoustic event. It has been well established in the scientific community that SEL measures this impact much more reliably than just the maximum sound level.

Because the SEL and the maximum sound level are both used to describe single events, there is sometimes confusion between the two, so the specific metric used should be clearly stated.

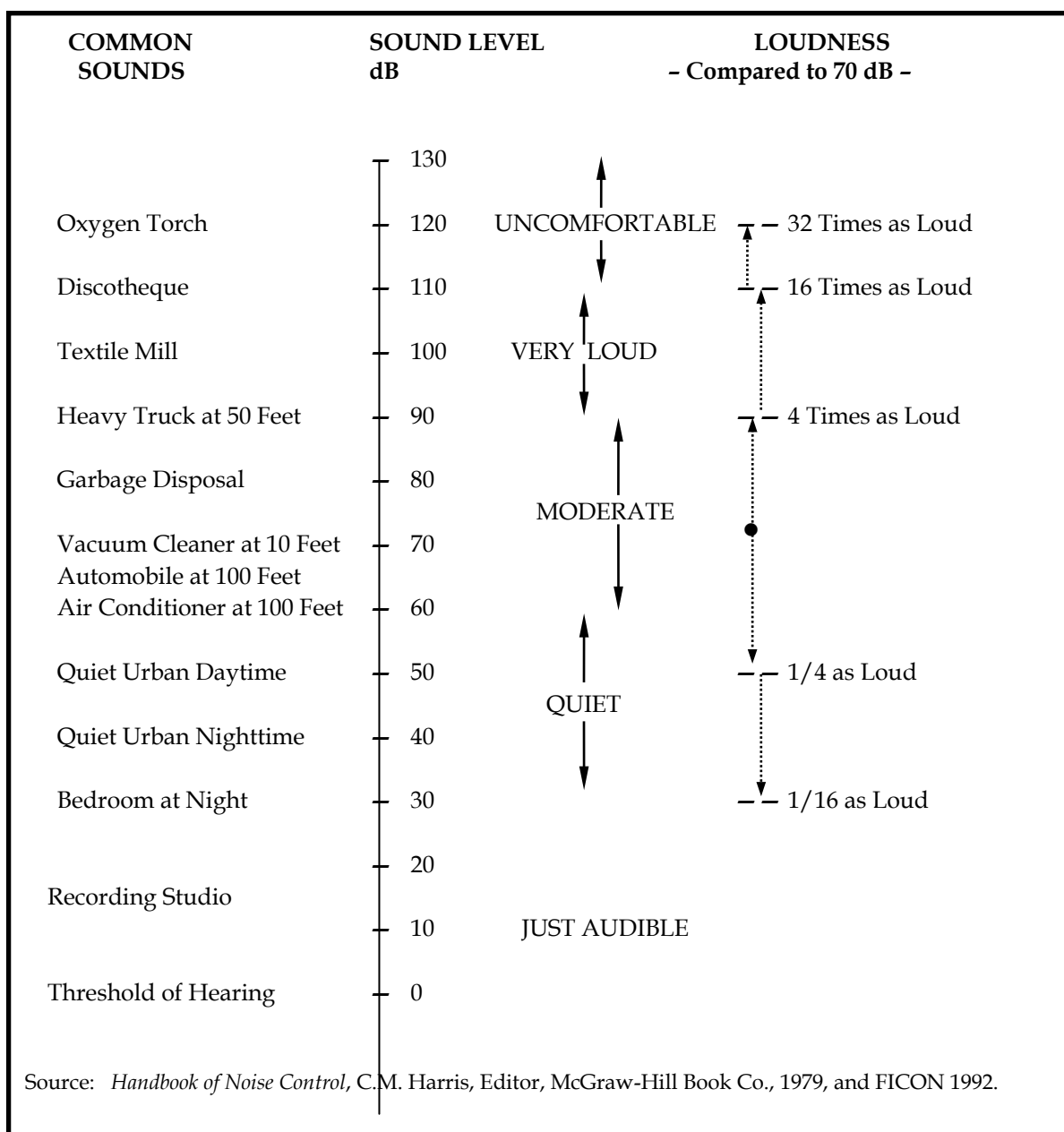


Figure D-1. Typical A-Weighted Sound Levels of Common Sounds

D1.1.4 Equivalent Sound Level

SEL can be computed for C-weighted levels (appropriate for impulsive sounds), and the results denoted CSEL or L_{CE} . SEL for A-weighted sound is sometimes denoted ASEL. Within this study, SEL is used for A-weighted sounds and CSEL for C-weighted.

For longer periods of time, total sound is represented by the equivalent continuous sound pressure level (L_{eq}). L_{eq} is the average sound level over some time period (often an hour or a day, but any explicit time span can be specified), with the averaging being done on the same

energy basis as used for SEL. SEL and L_{eq} are closely related, differing by (a) whether they are applied over a specific time period or over an event, and (b) whether the duration of the event is included or divided out.

Just as SEL has proven to be a good measure of the noise impact of a single event, L_{eq} has been established to be a good measure of the impact of a series of events during a given time period. Also, while L_{eq} is defined as an average, it is effectively a sum over that time period and is, thus, a measure of the cumulative impact of noise.

D1.1.5 Day-Night Average Sound Level

Noise tends to be more intrusive at night than during the day. This effect is accounted for by applying a 10-dB penalty to events that occur after 10 pm and before 7 am. If L_{eq} is computed over a 24-hour period with this nighttime penalty applied, the result is the day-night average sound level (L_{dn}).

L_{dn} is the community noise metric recommended by the USEPA (United States Environmental Protection Agency [USEPA] 1974) and has been adopted by most federal agencies (Federal Interagency Committee on Noise 1992). It has been well established that L_{dn} correlates well with community response to noise (Schultz 1978; Finegold *et al.* 1994). This correlation is presented in Section 1.3 of this appendix. While L_{dn} carries the nomenclature “average,” it incorporates all of the noise at a given location. For this reason, L_{dn} is often referred to as a “cumulative” metric. It accounts for the total, or cumulative, noise impact.

It was noted earlier that, for impulsive sounds, C-weighting is more appropriate than A-weighting. The day-night average sound level can be computed for C-weighted noise and is denoted CDNL or L_{cdn} . This procedure has been standardized, and impact interpretive criteria similar to those for L_{dn} have been developed (Committee on Hearing, Bioacoustics and Biomechanics 1981).

D1.1.6 Onset-Adjusted Monthly Day-Night Average Sound Level

Aircraft operations in military airspace, such as MOAs and Warning Areas, generate a noise environment somewhat different from other community noise environments. Overflights are sporadic, occurring at random times and varying from day to day and week to week. This situation differs from most community noise environments, in which noise tends to be continuous or patterned. Individual military overflight events also differ from typical community noise events in that noise from a low-altitude, high-air-speed flyover can have a rather sudden onset.

To represent these differences, the conventional L_{dn} metric is adjusted to account for the “surprise” effect of the sudden onset of aircraft noise events on humans (Plotkin *et al.* 1987; Stusnick *et al.* 1992; Stusnick *et al.* 1993). For aircraft exhibiting a rate of increase in sound level (called onset rate) of from 15 to 150 dB per second, an adjustment or penalty ranging from 0 to 11 dB is added to the normal SEL. Onset rates above 150 dB per second require an 11 dB penalty, while onset rates below 15 dB per second require no adjustment. The L_{dn} is then determined in the same manner as for conventional aircraft noise events and is designated as Onset-Rate Adjusted Day-Night Average Sound Level (abbreviated L_{dnmr}). Because of the

irregular occurrences of aircraft operations, the number of average daily operations is determined by using the calendar month with the highest number of operations. The monthly average is denoted L_{dnmr} . Noise levels are calculated the same way for both L_{dn} and L_{dnmr} . L_{dnmr} is interpreted by the same criteria as used for L_{dn} .

D1.2 Noise Impact

D1.2.1 Community Reaction

Studies of community annoyance to numerous types of environmental noise show that L_{dn} correlates well with impact. Schultz (1978) showed a consistent relationship between L_{dn} and annoyance. Schultz's original curve fit (Figure D-2) shows that there is a remarkable consistency in results of attitudinal surveys which relate the percentages of groups of people who express various degrees of annoyance when exposed to different L_{dn} .

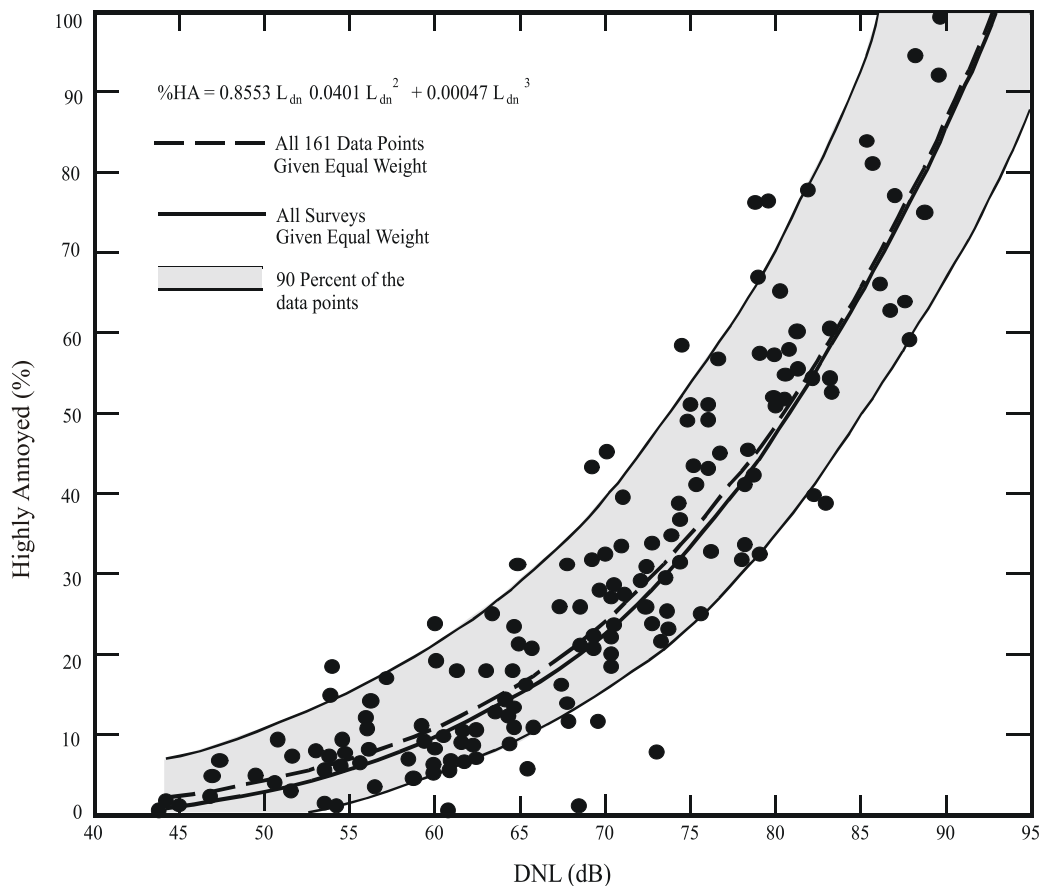


Figure D-2. Community Surveys of Noise Annoyance
(Source: Schultz 1978)

A more recent study has reaffirmed this relationship (Fidell *et al.* 1991). Figure D-3 (Federal Interagency Committee on Noise 1992) shows an updated form of the curve fit (Finegold *et al.* 1994) in comparison with the original. The updated fit, which does not differ substantially from the original, is the current preferred form. In general, correlation coefficients of 0.85 to 0.95 are

found between the percentages of groups of people highly annoyed and the level of average noise exposure. The correlation coefficients for the annoyance of individuals are relatively low, however, on the order of 0.5 or less. This is not surprising, considering the varying personal factors that influence the manner in which individuals react to noise. Nevertheless, findings substantiate that community annoyance to aircraft noise is represented quite reliably using L_{dn} .

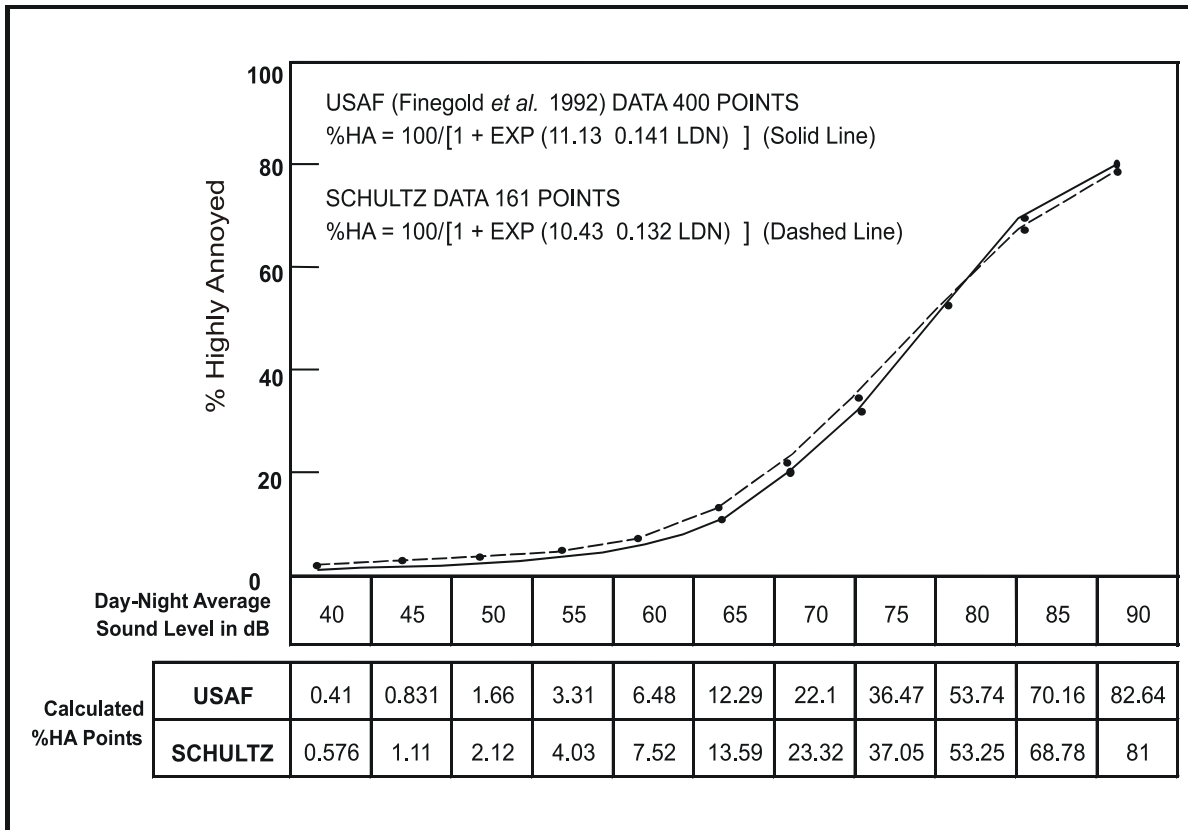


Figure D-3. Response of Communities to Noise; Comparison of Original (Schultz 1978) and Current (Finegold et al. 1994) Curve Fits.

As noted earlier for SEL, L_{dn} does not represent the sound level heard at any particular time, but rather represents the total sound exposure. L_{dn} accounts for the sound level of individual noise events, the duration of those events, and the number of events. Its use is endorsed by the scientific community (American National Standards Institute 1980, 1988; USEPA 1974; Federal Interagency Committee on Urban Noise 1980; Federal Interagency Committee on Noise 1992).

While L_{dn} is the best metric for quantitatively assessing cumulative noise impact, it does not lend itself to intuitive interpretation by non-experts. Accordingly, it is common for environmental noise analyses to include other metrics for illustrative purposes. A general indication of the noise environment can be presented by noting the maximum sound levels which can occur and the number of times per day noise events will be loud enough to be heard. Use of other metrics as supplements to L_{dn} has been endorsed by federal agencies (Federal Interagency Committee on Noise 1992).

The Schultz curve is generally applied to annual average L_{dn} . In Section 1.2, L_{dnmr} was described and presented as being appropriate for quantifying noise in military airspace. In the current study, the Schultz curve is used with L_{dnmr} as the noise metric. L_{dnmr} is always equal to or greater than L_{dn} , so impact is generally higher than would have been predicted if the onset rate and busiest-month adjustments were not accounted for.

There are several points of interest in the noise-annoyance relation. The first is L_{dn} of 65 dB. This is a level most commonly used for noise planning purposes and represents a compromise between community impact and the need for activities like aviation which do cause noise.

Areas exposed to L_{dn} above 65 dB are generally not considered suitable for residential use. The second is L_{dn} of 55 dB, which was identified by USEPA as a level "...requisite to protect the public health and welfare with an adequate margin of safety," (USEPA 1974) which is essentially a level below which adverse impact is not expected.

The third is L_{dn} of 75 dB. This is the lowest level at which adverse health effects could be credible (USEPA 1974). The very high annoyance levels correlated with L_{dn} of 75 dB make such areas unsuitable for residential land use.

Sonic boom exposure is measured by C-weighting, with the corresponding cumulative metric being CDNL. Correlation between CDNL and annoyance has been established, based on community reaction to impulsive sounds (Committee on Hearing, Bioacoustics and Biomechanics 1981). Values of the C-weighted equivalent to the Schultz curve are different than that of the Schultz curve itself. Table D-1 shows the relation between annoyance, L_{dn} , and CDNL.

Table D-1. Relation Between Annoyance, L_{dn} and CDNL

<i>CDNL</i>	<i>% Highly Annoyed</i>	<i>L_{dn}</i>
48	2	50
52	4	55
57	8	60
61	14	65
65	23	70
69	35	75

Interpretation of CDNL from impulsive noise is accomplished by using the CDNL versus annoyance values in Table D-1. CDNL can be interpreted in terms of an "equivalent annoyance" L_{dn} . For example, CDNL of 52, 61, and 69 dB are equivalent to L_{dn} of 55, 65, and 75 dB, respectively. If both continuous and impulsive noise occurs in the same area, impacts are assessed separately for each.

D1.2.2 Land Use Compatibility

As noted above, the inherent variability between individuals makes it impossible to predict accurately how any individual will react to a given noise event. Nevertheless, when a community is considered as a whole, its overall reaction to noise can be represented with a high degree of confidence. As described above, the best noise exposure metric for this correlation is

the L_{dn} or L_{dnmr} for military overflights. Impulsive noise can be assessed by relating CDNL to an “equivalent annoyance” L_{dn} , as outlined in Section 1.3.1.

In June 1980, an ad hoc Federal Interagency Committee on Urban Noise published guidelines (Federal Interagency Committee on Urban Noise 1980) relating L_{dn} to compatible land uses. This committee was composed of representatives from DoD, Transportation, and Housing and Urban Development; USEPA; and the Veterans Administration. Since the issuance of these guidelines, federal agencies have generally adopted these guidelines for their noise analyses.

Following the lead of the committee, DoD and FAA adopted the concept of land-use compatibility as the accepted measure of aircraft noise effect. The FAA included the committee’s guidelines in the Federal Aviation Regulations (United States Department of Transportation 1984).

These guidelines are reprinted in Table D-2, along with the explanatory notes included in the regulation. Although these guidelines are not mandatory (note the footnote “*” in the table), they provide the best means for determining noise impact in airport communities. In general, residential land uses normally are not compatible with outdoor L_{dn} values above 65 dB, and the extent of land areas and populations exposed to L_{dn} of 65 dB and higher provides the best means for assessing the noise impacts of alternative aircraft actions. In some cases, where noise change exceeds 3 dB, the 1992 Federal Interagency Committee on Noise indicates the 60 dB L_{dn} may be a more appropriate incompatibility level for densely populated areas.

D2 Noise Effects

The discussion in Section 1.3 presents the global effect of noise on communities. The following sections describe particular noise effects.

D2.1 Hearing Loss

There are situations where noise in and around airbases may exceed levels at which long-term noise-induced hearing loss is possible.

The first of these is a result of exposure to occupational noise by individuals working in known high noise exposure locations such as jet engine maintenance facilities or aircraft maintenance hangars. In this case, exposure of workers inside the base boundary area should be considered occupational, which is excluded from the DoD Noise Program by DoD Instruction 4715.13, and should be evaluated using the appropriate DoD component regulations for occupational noise exposure. The DoD, U.S. Air Force, and the National Institute of Occupational Safety and Health (NIOSH) have all established occupational noise exposure damage risk criteria (or “standard”) for hearing loss so as to not exceed 85 dB as an 8-hour time weighted average, with a 3 dB exchange rate in a work environment.

Table D-2. Land-Use Compatibility With Yearly Day-Night Average Sound Levels

Land Use	Yearly Day-Night Average Sound Level (L_{dn}) in dB					
	Below 65	65-70	70-75	75-80	80-85	Over 85
Residential						
Residential, other than mobile homes and transient lodgings	Y	N(1)	N(1)	N	N	N
Mobile home parks	Y	N	N	N	N	N
Transient lodgings	Y	N(1)	N(1)	N(1)	N	N
Public Use						
Schools	Y	N(1)	N(1)	N	N	N
Hospitals and nursing homes	Y	25	30	N	N	N
Churches, auditoria, and concert halls	Y	25	30	N	N	N
Government services	Y	Y	25	30	N	N
Transportation	Y	Y	Y(2)	Y(3)	Y(4)	Y(4)
Parking	Y	Y	Y(2)	Y(3)	Y(4)	N
Commercial Use						
Offices, business and professional	Y	Y	25	30	N	N
Wholesale and retail—building materials, hardware, and farm equipment	Y	Y	Y(2)	Y(3)	Y(4)	N
Retail trade—general	Y	Y	25	30	N	N
Utilities	Y	Y	Y(2)	Y(3)	Y(4)	N
Communication	Y	Y	25	30	N	N
Manufacturing and Production						
Manufacturing, general	Y	Y	Y(2)	Y(3)	Y(4)	N
Photographic and optical	Y	Y	25	30	N	N
Agriculture (except livestock) and forestry	Y	Y(6)	Y(7)	Y(8)	Y(8)	Y(8)
Livestock farming and breeding	Y	Y(6)	Y(7)	N	N	N
Mining and fishing, resource production and extraction	Y	Y	Y	Y	Y	Y
Recreational						
Outdoor sports arenas and spectator sports	Y	Y(5)	Y(5)	N	N	N
Outdoor music shells, amphitheaters	Y	N	N	N	N	N
Nature exhibits and zoos	Y	Y	N	N	N	N
Amusements, parks, resorts, and camps	Y	Y	Y	N	N	N
Golf courses, riding stables, and water recreation	Y	Y	25	30	N	N

Numbers in parentheses refer to notes.

* The designations contained in this table do not constitute a federal determination that any use of land covered by the program is acceptable or unacceptable under federal, state, or local law. The responsibility for determining the acceptable and permissible land uses and the relationship between specific properties and specific noise contours rests with the local authorities. FAA determinations under Part 150 are not intended to substitute federally determined land uses for those determined to be appropriate by local authorities in response to locally determined needs and values in achieving noise-compatible land uses.

KEY TO TABLE D-2

Y (YES) = Land Use and related structures compatible without restrictions.

N (No) = Land Use and related structures are not compatible and should be prohibited.

NLR = Noise Level Reduction (outdoor to indoor) to be achieved through incorporation of noise attenuation into the design and construction of the structure.

25, 30, or 35 = Land Use and related structures generally compatible; measures to achieve NLR of 25, 30, or 35 dB must be incorporated into design and construction of structures.

NOTES FOR TABLE D-2

- Where the community determines that residential or school uses must be allowed, measures to achieve outdoor-to-indoor Noise Level Reduction (NLR) of at least 25 dB and 30 dB should be incorporated into building codes and be considered in individual approvals. Normal residential construction can be expected to provide an NLR of 20 dB; thus the reduction requirements are often stated as 5, 10, or 15 dB over standard construction and normally assume mechanical ventilation and closed windows year-round. However, the use of NLR criteria will not eliminate outdoor noise problems.
- Measures to achieve NLR 25 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.
- Measures to achieve NLR 30 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.
- Measures to achieve NLR 35 dB must be incorporated into the design and construction of portions of these buildings where the public is received, office areas, noise-sensitive areas, or where the normal noise level is low.
- Land-use compatible provided special sound reinforcement systems are installed.
- Residential buildings require an NLR of 25.
- Residential buildings require an NLR of 30.
- Residential buildings not permitted.

The exchange rate is an increment of decibels that requires the halving of exposure time, or a decrement of decibels that requires the doubling of exposure time. For example, a 3 dB exchange rate requires that noise exposure time be halved for each 3 dB increase in noise level. Therefore, an individual would achieve the limit for risk criteria at 88 dB, for a time period of 4 hours, and at 91 dB, for a time period of 2 hours.) (The standard assumes “quiet” (where an individual remains in an environment with noise levels less than 72 dB) for the balance of the 24-hour period. Also, Air Force and Occupational Safety and Health Administration (OSHA) occupational standards prohibit any unprotected worker exposure to continuous (i.e., of a duration greater than one second) noise exceeding a 115 dB sound level. OSHA established this additional standard to reduce the risk of workers developing noise-induced hearing loss.

The second situation where individuals may be exposed to high noise levels is when noise contours resulting from flight operations in and around the installation reach or exceed 80 dB L_{dn} both on- and off-base. To assess the potential impacts of this situation, the DoD published a policy for assessing hearing loss risk (Undersecretary of Defense for Acquisition Technology and Logistics 2009). The policy defines the conditions under which assessments are required, references the methodology from a 1982 USEPA report, and describes how the assessments are to be calculated. The policy reads as follows:

“Current and future high performance aircraft create a noise environment in which the current impact analysis based primarily on annoyance may be insufficient to capture the full range of impacts on humans. As part of the noise analysis in all future environmental impact statements, DoD components will use the 80 Day-Night A-Weighted (L_{dn}) noise contour to identify populations at the most risk of potential hearing loss. DoD components will use as part of the analysis, as appropriate, a calculation of the Potential Hearing Loss (PHL) of the at risk population. The PHL (sometimes referred to as Population Hearing Loss) methodology is defined in USEPA Report No. 550/9-82-105, *Guidelines for Noise Impact Analysis*” (1982).

The USEPA *Guidelines for Noise Impact Analysis* (hereafter referred to as “USEPA Guidelines”) specifically addresses the criteria and procedures for assessing the noise-induced hearing loss in terms of the Noise-Induced Permanent Threshold Shift (NIPTS), a quantity that defines the permanent change in hearing level, or threshold, caused by exposure to noise (USEPA 1982). Numerically, the NIPTS is the change in threshold averaged over the frequencies 0.5, 1, 2, and 4 kilohertz (kHz) that can be expected from daily exposure to noise over a normal working lifetime of 40 years, with the exposure beginning at an age of 20 years. A grand average of the NIPTS over time (40 years) and hearing sensitivity (10 to 90 percentiles of the exposed population) is termed the Average NIPTS. The Average NIPTS attributable to noise exposure for ranges of noise level in terms of L_{dn} is given in Table D-3.

Table D-3. Average NIPTS and 10th Percentile NIPTS as a Function of L_{dn} *

L_{dn}	Average NIPTS (dB)**	10 th Percentile NIPTS (dB)**
80-81	3.0	7.0
81-82	3.5	8.0
82-83	4.0	9.0
83-84	4.5	10.0
84-85	5.5	11.0
85-86	6.0	12.0
86-87	7.0	13.5
87-88	7.5	15.0
88-89	8.5	16.5
89-90	9.5	18.0

dB = decibels; L_{dn} = Day-night Average Sound Level; NIPTS = Noise-induced Permanent Threshold Shift

*Relationships between L_{dn} and NIPTS were derived from CHABA 1977.

**NIPTS values rounded to the nearest 0.5 dB.

Thus, for a noise exposure within the 80-81 L_{dn} contour band, the expected lifetime average value of NIPTS (hearing loss) is 3.0 dB. The Average NIPTS is estimated as an average over all people included in the at risk population. The actual value of NIPTS for any given person will depend on their physical sensitivity to noise – some will experience more loss of hearing than others. The USEPA Guidelines provide information on this variation in sensitivity in the form of the NIPTS exceeded by 10 percent of the population, which is included in Table D-3 in the “10th Percentile NIPTS” column. As in the example above, for individuals within the 80-81 L_{dn} contour band, the most sensitive of the population, would be expected to show no more degradation to their hearing than experiencing a 7.0 dB Average NIPTS hearing loss. And while the DoD policy requires that hearing loss risk be estimated for the population exposed to 80 dB L_{dn} or greater, this does not preclude populations outside the 80 L_{dn} contour, i.e. at lower exposure levels, from being at some degree of risk of hearing loss.

The actual noise exposure for any person living in the at-risk area is determined by the time that person is outdoors and directly exposed to the noise. Many of the people living within the applicable L_{dn} contour will not be present during the daytime hours – they may be at work, at school, or involved in other activities outside the at-risk area. Many will be inside their homes and thereby exposed to lower noise levels, benefitting from the noise attenuation provided by the house structure. The actual activity profile is usually impossible to generalize. For the purposes of this analysis, it was assumed that residents are fully exposed to the L_{dn} level of noise appropriate for their residence location and the Average NIPTS taken from Table D-3. 3).

The quantity to be reported is the number of people living within each 1 dB contour band inside the 80 dB L_{dn} contour who are at risk for hearing loss given by the Average NIPTS for that band. The average nature of Average NIPTS means that it underestimates the magnitude of the potential hearing loss for the population most sensitive to noise. Therefore, in the interest of disclosure, the information to be reported includes both the Average NIPTS and the 10th percentile NIPTS Table D-3. 3) for each 1 dB contour band inside the 80 L_{dn} contour.

According to the USEPA documents titled Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety, and Public Health and Welfare Criteria for Noise, changes in hearing levels of less than 5 dB are generally

not considered noticeable or significant. There is no known evidence that an NIPTS of less than 5 dB is perceptible or has any practical significance for the individual. Furthermore, the variability in audiometric testing is generally assumed to be ± 5 dB. The preponderance of available information on hearing loss risk is from the workplace with continuous exposure throughout the day for many years. Clearly, this data is applicable to the adult working population. According to a report by Ludlow and Sixsmith, there were no significant differences in audiometric test results between military personnel, who as children had lived in or near stations where jet operations were based, and a similar group who had no such exposure as children (Ludlow and Sixsmith 1999). Hence, for the purposes of PHL analysis, it can be assumed that the limited data on hearing loss is applicable to the general population, including children, and provides a conservative estimate of hearing loss.

D2.2 *Nonauditory Health Effects*

Nonauditory health effects of long-term noise exposure, where noise may act as a risk factor, have not been found to occur at levels below those protective against noise-induced hearing loss, described above. Most studies attempting to clarify such health effects have found that noise exposure levels established for hearing protection will also protect against any potential nonauditory health effects, at least in workplace conditions. The best scientific summary of these findings is contained in the lead paper at the National Institutes of Health Conference on Noise and Hearing Loss, held on January 22–24, in Washington, D.C., which states, “The nonauditory effects of chronic noise exposure, when noise is suspected to act as one of the risk factors in the development of hypertension, cardiovascular disease, and other nervous disorders, have never been proven to occur as chronic manifestations at levels below these criteria (an average of 75 dBA for complete protection against hearing loss for an eight-hour day)” (von Gierke 1990; parenthetical wording added for clarification). At the International Congress (1988) on Noise as a Public Health Problem, most studies attempting to clarify such health effects did not find them at levels below the criteria protective of noise-induced hearing loss; and even above these criteria, results regarding such health effects were ambiguous.

Consequently, it can be concluded that establishing and enforcing exposure levels protecting against noise-induced hearing loss would not only solve the noise-induced hearing loss problem but also any potential nonauditory health effects in the work place.

Although these findings were directed specifically at noise effects in the work place, they are equally applicable to aircraft noise effects in the community environment. Research studies regarding the nonauditory health effects of aircraft noise are ambiguous, at best, and often contradictory. Yet, even those studies which purport to find such health effects use time-average noise levels of 75 dB and higher for their research.

For example, in an often-quoted paper, two University of California at Los Angeles researchers found a relation between aircraft noise levels under the approach path to Los Angeles International Airport and increased mortality rates among the exposed residents by using an average noise exposure level greater than 75 dB for the “noise-exposed” population (Meecham and Shaw 1979). Nevertheless, three other University of California at Los Angeles professors analyzed those same data and found no relation between noise exposure and mortality rates (Frerichs *et al.* 1980).

As a second example, two other University of California at Los Angeles researchers used this same population near Los Angeles International Airport to show a higher rate of birth defects during the period of 1970 to 1972 when compared with a control group residing away from the airport (Jones and Tauscher 1978). Based on this report, a separate group at the United States Centers for Disease Control performed a more thorough study of populations near Atlanta's Hartsfield International Airport for 1970 to 1972 and found no relation in their study of 17 identified categories of birth defects to aircraft noise levels above 65 dB (Edmonds 1979).

A recent review of health effects, prepared by a Committee of the Health Council of The Netherlands (Committee of the Health Council of the Netherlands 1996), analyzed currently available published information on this topic. The committee concluded that the threshold for possible long-term health effects was a 16-hour (6:00 a.m. to 10:00 p.m.) L_{eq} of 70 dB. Projecting this to 24 hours and applying the 10 dB nighttime penalty used with L_{dn} , this corresponds to L_{dn} of about 75 dB. The study also affirmed the risk threshold for hearing loss, as discussed earlier.

In summary, there is no scientific basis for a claim that potential health effects exist for aircraft time-average sound levels below 75 dB.

D2.3 Annoyance

The primary effect of aircraft noise on exposed communities is one of annoyance. Noise annoyance is defined by the USEPA as any negative subjective reaction on the part of an individual or group (USEPA 1974). As noted in the discussion of L_{dn} above, community annoyance is best measured by that metric.

Because the USEPA Levels Document (USEPA 1974) identified L_{dn} of 55 dB as “. . . requisite to protect public health and welfare with an adequate margin of safety,” it is commonly assumed that 55 dB should be adopted as a criterion for community noise analysis. From a noise exposure perspective, that would be an ideal selection. However, financial and technical resources are generally not available to achieve that goal. Most agencies have identified L_{dn} of 65 dB as a criterion which protects those most impacted by noise, and which can often be achieved on a practical basis (Federal Interagency Committee on Noise 1992). This corresponds to about 13 percent of the exposed population being highly annoyed.

Although L_{dn} of 65 dB is widely used as a benchmark for significant noise impact, and is often an acceptable compromise, it is not a statutory limit, and it is appropriate to consider other thresholds in particular cases.

In this Draft EA, no specific threshold is used. The noise in the affected environment is evaluated on the basis of the information presented in this appendix and in the body of the Draft EA.

Community annoyance from sonic booms is based on CDNL, as discussed in Section 1.3. These effects are implicitly included in the “equivalent annoyance” CDNL values in Table D-1, since those were developed from actual community noise impact.

D2.4 *Speech Interference*

Speech interference associated with aircraft noise is a primary cause of annoyance to individuals on the ground. The disruption of routine activities in the home, such as radio or television listening, telephone use, or family conversation, gives rise to frustration and irritation. The quality of speech communication is also important in classrooms, offices, and industrial settings and can cause fatigue and vocal strain in those who attempt to communicate over the noise. Research has shown that the use of the SEL metric will measure speech interference successfully, and that a SEL exceeding 65 dB will begin to interfere with speech communication.

D2.5 *Sleep Interference*

Sleep interference is another source of annoyance associated with aircraft noise. This is especially true because of the intermittent nature and content of aircraft noise, which is more disturbing than continuous noise of equal energy and neutral meaning.

Sleep interference may be measured in either of two ways. “Arousal” represents actual awakening from sleep, while a change in “sleep stage” represents a shift from one of four sleep stages to another stage of lighter sleep without actual awakening. In general, arousal requires a somewhat higher noise level than does a change in sleep stage.

An analysis sponsored by the Air Force summarized 21 published studies concerning the effects of noise on sleep (Pearsons *et al.* 1989). The analysis concluded that a lack of reliable in-home studies, combined with large differences among the results from the various laboratory studies, did not permit development of an acceptably accurate assessment procedure. The noise events used in the laboratory studies and in contrived in-home studies were presented at much higher rates of occurrence than would normally be experienced. None of the laboratory studies were of sufficiently long duration to determine any effects of habituation, such as that which would occur under normal community conditions. A recent extensive study of sleep interference in people’s own homes (Ollerhead 1992) showed very little disturbance from aircraft noise.

There is some controversy associated with the recent studies, so a conservative approach should be taken in judging sleep interference. Based on older data, the USEPA identified an indoor L_{dn} of 45 dB as necessary to protect against sleep interference (USEPA 1974). Assuming a very conservative structural noise insulation of 20 dB for typical dwelling units, this corresponds to an outdoor L_{dn} of 65 dB as minimizing sleep interference.

A 1984 publication reviewed the probability of arousal or behavioral awakening in terms of SEL (Kryter 1984). Figure D-4, extracted from Figure 10.37 of Kryter (1984), indicates that an indoor SEL of 65 dB or lower should awaken less than 5 percent of those exposed. These results do not include any habituation over time by sleeping subjects. Nevertheless, this provides a reasonable guideline for assessing sleep interference and corresponds to similar guidance for speech interference, as noted above.

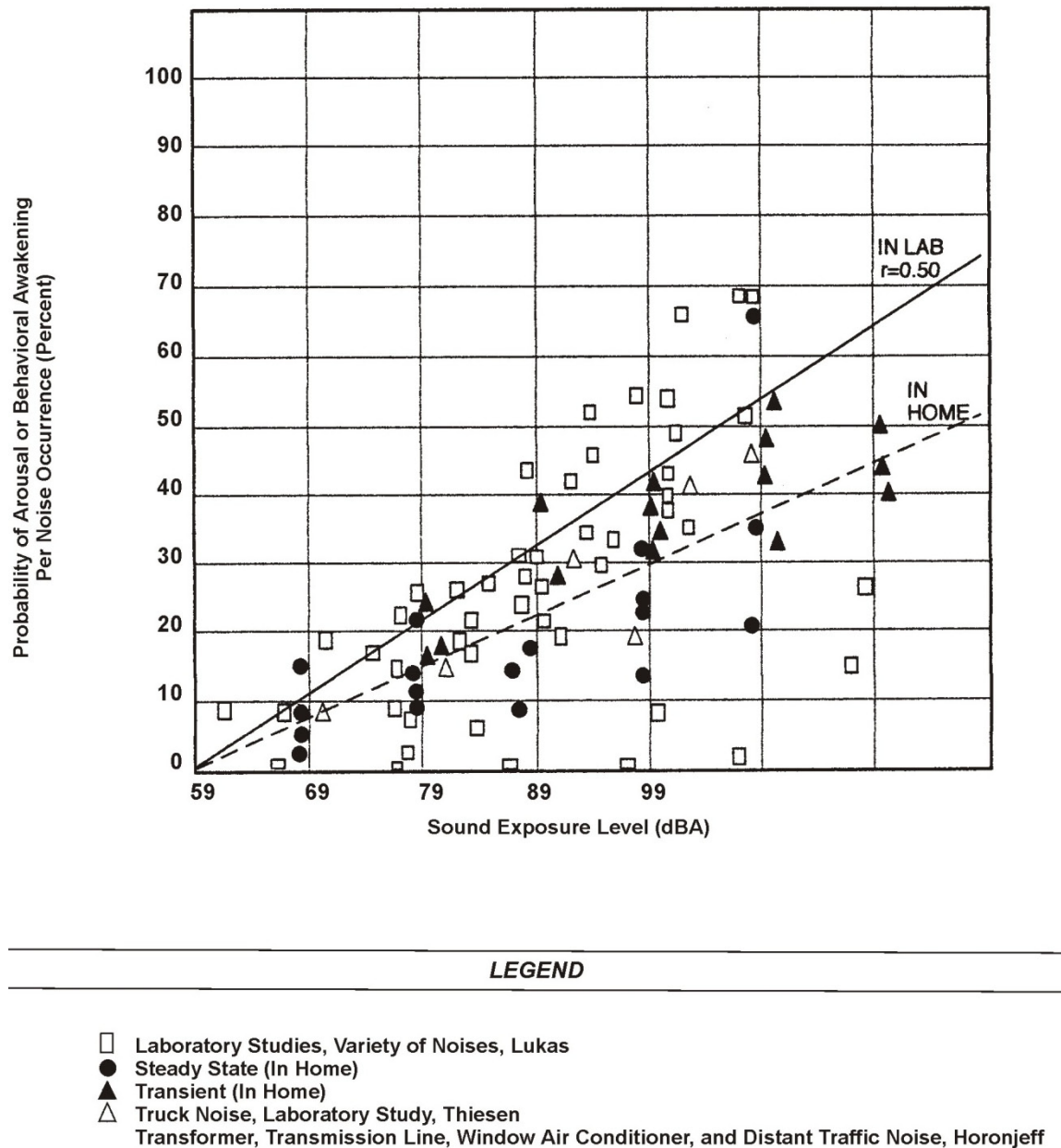


Figure D-4. Probability of Arousal or Behavioral Awakening in Terms of Sound Exposure Level

D2.6 Noise Effects on Domestic Animals and Wildlife

Animal species differ greatly in their responses to noise. Each species has adapted, physically and behaviorally, to fill its ecological role in nature, and its hearing ability usually reflects that role. Animals rely on their hearing to avoid predators, obtain food, and communicate with and attract other members of their species. Aircraft noise may mask or interfere with these

functions. Secondary effects may include nonauditory effects similar to those exhibited by humans: stress, hypertension, and other nervous disorders. Tertiary effects may include interference with mating and resultant population declines.

D2.7 *Noise Effects on Structures*

D2.7.1 Subsonic Aircraft Noise

Normally, the most sensitive components of a structure to airborne noise are the windows and, infrequently, the plastered walls and ceilings. An evaluation of the peak sound pressures impinging on the structure is normally sufficient to determine the possibility of damage. In general, at sound levels above 130 dB, there is the possibility of the excitation of structural component resonance. While certain frequencies (such as 30 Hz for window breakage) may be of more concern than other frequencies, conservatively, only sounds lasting more than one second above a sound level of 130 dB are potentially damaging to structural components (National Research Council/National Academy of Sciences 1977).

A study directed specifically at low-altitude, high-speed aircraft showed that there is little probability of structural damage from such operations (Sutherland 1989). One finding in that study is that sound levels at damaging frequencies (e.g., 30 Hz for window breakage or 15 to 25 Hz for whole-house response) are rarely above 130 dB.

Noise-induced structural vibration may also cause annoyance to dwelling occupants because of induced secondary vibrations, or “rattle,” of objects within the dwelling, such as hanging pictures, dishes, plaques, and bric-a-brac. Window panes may also vibrate noticeably when exposed to high levels of airborne noise, causing homeowners to fear breakage. In general, such noise-induced vibrations occur at sound levels above those considered normally incompatible with residential land use. Thus assessments of noise exposure levels for compatible land use should also be protective of noise-induced secondary vibrations.

D2.7.2 Sonic Booms

Sonic booms are commonly associated with structural damage. Most damage claims are for brittle objects, such as glass and plaster. Table D-4 summarizes the threshold of damage that might be expected at various overpressures. There is a large degree of variability in damage experience, and much damage depends on the pre-existing condition of a structure. Breakage data for glass, for example, spans a range of two to three orders of magnitude at a given overpressure. At 1 psf, the probability of a window breaking ranges from one in a billion (Sutherland 1990) to one in a million (Hershey and Higgins 1976). These damage rates are associated with a combination of boom load and glass condition. At 10 psf, the probability of breakage is between one in a hundred and one in a thousand. Laboratory tests of glass (White 1972) have shown that properly installed window glass will not break at overpressures below 10 psf, even when subjected to repeated booms, but in the real world glass is not in pristine condition.

Table D-4. Possible Damage to Structures From Sonic Booms

Sonic Boom Overpressure Nominal (psf)	Item Affected	Type of Damage
0.5 - 2	Plaster	Fine cracks; extension of existing cracks; more in ceilings; over door frames; between some plaster boards.
	Glass	Rarely shattered; either partial or extension of existing cracks.
	Roof	Slippage of existing loose tiles/slates; sometimes new cracking of old slates at nail hole.
	Damage to outside walls	Existing cracks in stucco extended.
	Bric-a-brac	Those carefully balanced or on edges can fall; fine glass, such as large goblets, can fall and break.
	Other	Dust falls in chimneys.
2 - 4	Glass, plaster, roofs, ceilings	For elements nominally in good condition, failures show that would have been difficult to forecast in terms of their existing localized condition.
4 - 10	Glass	Regular failures within a population of well-installed glass; industrial as well as domestic greenhouses.
	Plaster	Partial ceiling collapse of good plaster; complete collapse of very new, incompletely cured, or very old plaster.
	Roofs	High probability rate of failure in slurry wash in nominally good state; some chance of failures in tiles on modern roofs; light roofs (bungalow) or large area can move bodily.
	Walls (out)	Old, free standing, in fairly good condition can collapse.
	Walls (in)	Internal ("party") walls known to move at 10 psf.
Greater than 10	Glass	Some good window glass will fail when exposed to regular sonic booms from the same direction. Glass with existing faults could shatter and fly. Large window frames move.
	Plaster	Most plaster affected.
	Ceilings	Plaster boards displaced by nail popping.
	Roofs	Most slate/slurry roofs affected, some badly; large roofs having good tile can be affected; some roofs bodily displaced causing gale-end and wall-plate cracks; domestic chimneys dislodged if not in good condition.
	Walls	Internal party walls can move even if carrying fittings such as hand basins or taps; secondary damage due to water leakage.
	Bric-a-brac	Some nominally secure items can fall; e.g., large pictures, especially if fixed to party walls.

Source: Haber and Nakaki 1989

Some degree of damage to glass and plaster should thus be expected whenever there are sonic booms, but usually at the low rates noted above. In general, structural damage from sonic booms should be expected only for overpressures above 10 psf.

D2.8 *Noise Effects on Terrain*

D2.8.1 Subsonic Aircraft Noise

Members of the public often believe that noise from low-flying aircraft can cause avalanches or landslides by disturbing fragile soil or snow structures in mountainous areas. There are no known instances of such effects, and it is considered improbable that such effects will result from routine, subsonic aircraft operations.

D2.8.2 Sonic Booms

In contrast to subsonic noise, sonic booms are considered to be a potential trigger for snow avalanches. Avalanches are highly dependent on the physical status of the snow, and do occur spontaneously. They can be triggered by minor disturbances, and there are documented accounts of sonic booms triggering avalanches. Switzerland routinely restricts supersonic flight during avalanche season.

Landslides are not an issue for sonic booms. There was one anecdotal report of a minor landslide from a sonic boom generated by the Space Shuttle during landing, but there is no credible mechanism or consistent pattern of reports.

D2.9 *Noise Effects on Historical and Archaeological Sites*

Because of the potential for increased fragility of structural components of historical buildings and other historical sites, aircraft noise may affect such sites more severely than newer, modern structures. Again, there are few scientific studies of such effects to provide guidance for their assessment.

One study involved the measurements of sound levels and structural vibration levels in a superbly restored plantation house, originally built in 1795, and now situated approximately 1,500 feet from the centerline at the departure end of Runway 19L at Washington Dulles International Airport. These measurements were made in connection with the proposed scheduled operation of the supersonic Concorde airplane at Dulles (Wesler 1977). There was special concern for the building's windows, since roughly half of the 324 panes were original. No instances of structural damage were found. Interestingly, despite the high levels of noise during Concorde takeoffs, the induced structural vibration levels were actually less than those induced by touring groups and vacuum cleaning within the building itself.

As noted above for the noise effects of noise-induced vibrations on normal structures, assessments of noise exposure levels for normally compatible land uses should also be protective of historic and archaeological sites.

D3 Noise Modeling

D3.1 Subsonic Aircraft Noise

An aircraft in subsonic flight generally emits noise from two sources: the engines and flow noise around the airframe. Noise generation mechanisms are complex and, in practical models,

the noise sources must be based on measured data. The Air Force has developed a series of computer models and aircraft noise databases for this purpose. The models include NOISEMAP (Moulton 1992) for noise around airbases, ROUTEMAP (Lucas and Plotkin 1988) for noise associated with low-level training routes, and MR_NMAP (Lucas and Calamia 1996) for use in MOAs and ranges. These models use the NOISEFILE database developed by the Air Force. NOISEFILE data includes SEL and L_{Amax} as a function of speed and power setting for aircraft in straight flight.

Noise from an individual aircraft is a time-varying continuous sound. It is first audible as the aircraft approaches, increases to a maximum when the aircraft is near its closest point, then diminishes as it departs. The noise depends on the speed and power setting of the aircraft and its trajectory. The models noted above divide the trajectory into segments whose noise can be computed from the data in NOISEFILE. The contributions from these segments are summed.

MR_NMAP was used to compute noise levels in the airspace. The primary noise metric computed by MR_NMAP was L_{dnmr} averaged over each airspace. Supporting routines from NOISEMAP were used to calculate SEL and L_{Amax} for various flight altitudes and lateral offsets from a ground receiver position.

D3.2 *Sonic Booms*

When an aircraft moves through the air, it pushes the air out of its way. At subsonic speeds, the displaced air forms a pressure wave that disperses rapidly. At supersonic speeds, the aircraft is moving too quickly for the wave to disperse, so it remains as a coherent wave. This wave is a sonic boom. When heard at the ground, a sonic boom consists of two shock waves (one associated with the forward part of the aircraft, the other with the rear part) of approximately equal strength and (for fighter aircraft) separated by 100 to 200 milliseconds. When plotted, this pair of shock waves and the expanding flow between them have the appearance of a capital letter "N," so a sonic boom pressure wave is usually called an "N-wave." An N-wave has a characteristic "bang-bang" sound that can be startling. Figure D-5 shows the generation and evolution of a sonic boom N-wave under the aircraft. Figure D-6 shows the sonic boom pattern for an aircraft in steady supersonic flight. The boom forms a cone that is said to sweep out a "carpet" under the flight track.

The complete ground pattern of a sonic boom depends on the size, shape, speed, and trajectory of the aircraft. Even for a nominally steady mission, the aircraft must accelerate to supersonic speed at the start, decelerate back to subsonic speed at the end, and usually change altitude. Figure D-7 illustrates the complexity of a nominal full mission.

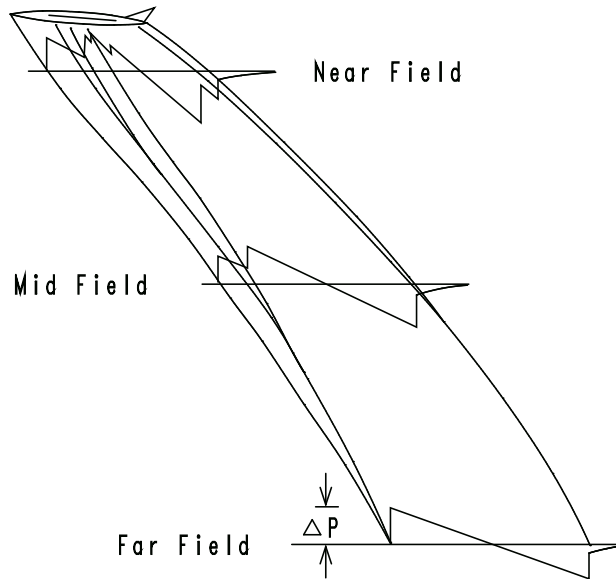


Figure D-5. Sonic Boom Generation, and Evolution to N-wave

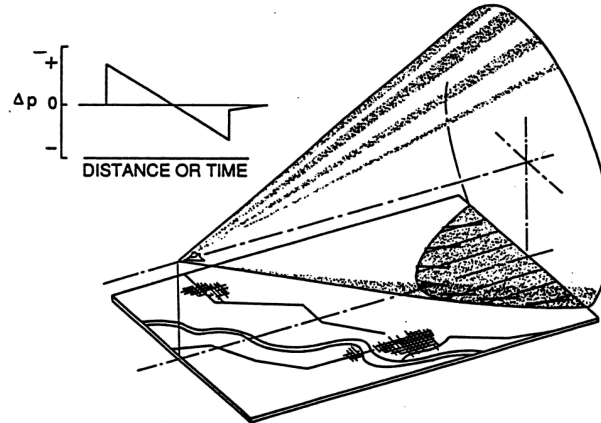


Figure D-6. Sonic Boom Carpet in Steady Flight

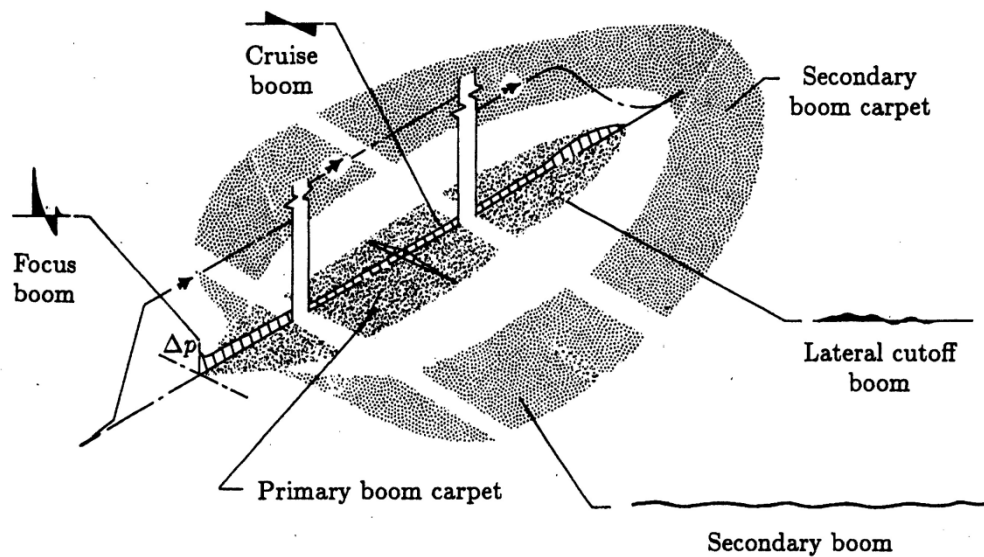


Figure D-7. Complex Sonic Boom Pattern for Full Mission

The Air Force's PCBoom4 computer program (Plotkin and Grandi 2002) can be used to compute the complete sonic boom footprint for a given single event, accounting for details of a particular maneuver.

Supersonic operations for the proposed action and alternatives are, however, associated with air combat training, which cannot be described in the deterministic manner that PCBoom4 requires. Supersonic events occur as aircraft approach an engagement, break at the end, and maneuver for advantage during the engagement. Long time cumulative sonic boom exposure, CDNL, is meaningful for this kind of environment.

Long-term sonic boom measurement projects have been conducted in four supersonic air combat training airspaces: White Sands, New Mexico (Plotkin *et al.* 1989); the eastern portion of the Goldwater Range, Arizona (Plotkin *et al.* 1992); the Elgin MOA at Nellis AFB, Nevada (Frampton *et al.* 1993); and the western portion of the Goldwater Range (Page *et al.* 1994). These studies included analysis of schedule and air combat maneuvering instrumentation data and supported development of the 1992 BOOMAP model (Plotkin *et al.* 1992). The current version of BOOMAP (Frampton *et al.* 1993; Plotkin 1996) incorporates results from all four studies.

Because BOOMAP is directly based on long-term measurements, it implicitly accounts for such variables as maneuvers, statistical variations in operations, atmosphere effects, and other factors.

Figure D-8 shows a sample of supersonic flight tracks measured in the air combat training airspace at White Sands (Plotkin *et al.* 1989). The tracks fall into an elliptical pattern aligned with preferred engagement directions in the airspace. Figure D-9 shows the CDNL contours that were fit to six months of measured booms in that airspace. The subsequent measurement programs refined the fit, and demonstrated that the elliptical maneuver area is related to the size and shape of the airspace (Frampton *et al.* 1993). BOOMAP quantifies the size and shape of

CDNL contours, and also numbers of booms per day, in air combat training airspaces. That model was used for prediction of cumulative sonic boom exposure in the study area.

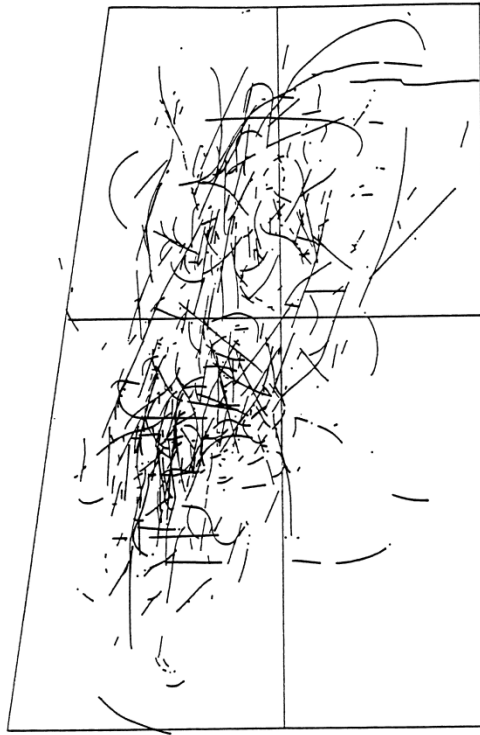


Figure D-8. Supersonic Flight Tracks in Supersonic Air Combat Training Airspace

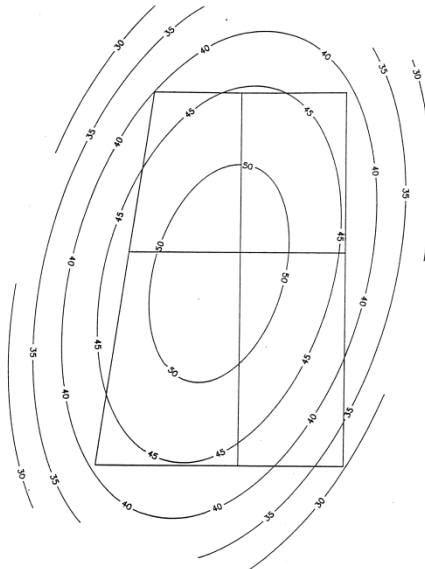


Figure D-9. Elliptical CDNL Contours in Supersonic Air Combat Training Airspace

D4 Summary of Operational Parameters Used in Noise Modeling at JBER-Elmendorf

Operational parameters used in modeling of noise in the vicinity of JBER-Elmendorf are summarized below. Parameters presented are representative of current operations at JBER-Elmendorf as reported during operator interviews held in August 2009. Operations of F-22 and C-17 aircraft have the greatest potential to affect off-installation noise sensitive areas. Operations data for these two aircraft were updated and revised in December 2010 and March 2011. Runway usage and the number of events per average busy day are critical factors affecting time-averaged noise levels. Table D-5 presents the percent of total arrivals, departures, and closed patterns that use each runway as well as the number of each type of event that occurs per average busy day. Increased usage of the crosswind runway (16/34) has the potential to increase noise levels in residential areas south of JBER-Elmendorf to greater than 65 L_{dn} .

Table D-5. Summary of Operational Parameters Used at JBER-Elmendorf

Aircraft	Operation Type	# per Average Busy Day	% Runway Usage			
			6	16	24	34
C-12	Arrival	2.65	76	1	15	8
	Closed	1.33	97	0	0	3
	Departure	2.65	26	9	65	0
	Interfacility	0	n/a	n/a	n/a	n/a
C-130	Arrival	8.98	71	12	17	0
	Closed	7.60	69	31	0	0
	Departure	8.98	80	0	20	0
	Interfacility	5.90	64	0	0	36
C-17	Arrival	3.01	95	4	1	0
	Closed	9.69	83	7	8	1
	Departure	3.01	85	0	15	0
	Interfacility	8.78	76	0	24	0
E-3	Arrival	1.00	73	0	27	0
	Closed	3.11	76	0	24	0
	Departure	1.00	60	0	40	0
	Interfacility	0	n/a	n/a	n/a	n/a
F-22	Arrival	19.05	100	0	0	0
	Closed	2.73	100	0	0	0
	Departure	19.05	75	25	0	0
	Interfacility	0.00	n/a	n/a	n/a	n/a
Aeroclub	Arrival	5.38	90	2	5	3
	Closed	0.97	90	2	5	3
	Departure	5.38	90	2	5	3
	Interfacility	0	n/a	n/a	n/a	n/a
UC-35	Arrival	2.04	85	2	10	3
	Closed	0.07	90	3	4	3
	Departure	2.04	95	1	2	2
	Interfacility	0	n/a	n/a	n/a	n/a

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Appendix E

Sec 7 (ESA) Compliance Wildlife Analysis for F-22 Plus UP Environmental Assessment,
Joint Base Elmendorf-Richardson (JBER), Alaska

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**SECTION 7 (ENDANGERED SPECIES ACT) COMPLIANCE
WILDLIFE ANALYSIS FOR F-22 PLUS-UP ENVIRONMENTAL
ASSESSMENT**

JOINT BASE ELMENDORF-RICHARDSON (JBER), ALASKA

February 2011

SECTION 7 (ENDANGERED SPECIES ACT) COMPLIANCE WILDLIFE ANALYSIS FOR F-22 PLUS- UP ENVIRONMENTAL ASSESSMENT, JOINT BASE ELMENDORF-RICHARDSON (JBER), ALASKA

1.1 Introduction

The United States Air Force (Air Force) is preparing an F-22 Plus-Up Environmental Assessment (EA) to evaluate the potential environmental consequences of the proposal to add six primary and one back-up F-22 aircraft to the Joint Base Elmendorf-Richardson (JBER) F-22 inventory, an increase in primary aircraft of approximately 17 percent.

1.2 Purpose and Need for F-22 Plus-Up at JBER

In 2006 the Air Force selected Elmendorf Air Force Base (AFB), Alaska, as the location for the Second F-22 Operational Wing [F-22 Beddown Environmental Assessment (EA), Elmendorf, Alaska, and Finding of No Significant Impact (FONSI), date 2006].

1.2.1 Purpose for F-22 Plus-Up at JBER

On July 29, 2010, the Department of the Air Force announced actions to consolidate the F-22 fleet. The Secretary of the Air Force and the Chief of Staff of the Air Force determined that the most effective basing for the F-22 requires redistributing aircraft from one Holloman AFB, New Mexico F-22 squadron to existing F-22 units at JBER; Langley AFB, Virginia; and Nellis AFB, Nevada. The second Holloman AFB F-22 squadron would be relocated to Tyndall AFB, Florida, an existing F-22 base. This consolidation would maximize combat aircraft and squadrons available for contingencies, and enhance F-22 operational flexibility (Air Force 2010). The purpose of the proposed plus-up of F-22 aircraft at JBER is to provide additional Air Force capabilities at a strategic location to meet mission responsibilities for worldwide deployment.

1.2.2 Need for F-22 Plus-Up at JBER

Two squadrons of F-15C aircraft and one squadron of F-15E aircraft were relocated from JBER between 2005 and 2010. Since World War II, JBER has provided an advanced location on U.S. soil for projection of U.S. global interests. Additional F-22 aircraft are needed at JBER to provide U.S. Air Force capability to respond efficiently to national objectives, be available for contingencies, and enhance F-22 operational flexibility.

1.3 Project Description

The Proposed Action is to augment the existing F-22 Operational Wing at JBER with six primary aircraft and one backup aircraft. This augmentation, when added to the existing JBER 36 primary and three back-up F-22 aircraft, would result in two F-22 squadrons with 21 primary and two back-up aircraft each. Addition of the six primary and one back-up F-22 aircraft would

not require additional construction or physical modification of habitat, and no changes would occur to JBER Water Resources, Hazardous Materials/Waste, Cultural Resources, and Geology and Soils. No changes to current F-22 flight paths or approach and departure patterns would occur. With the addition of the six operational aircraft to the existing inventory, an increase in F-22 sorties of approximately 21 percent is expected to result. The "no action" alternative considered in the EA would not add seven aircraft to the inventory.

1.4 Threatened, Endangered, and Candidate Species to be Evaluated

Threatened, Endangered, and Candidate Species Identified by USFWS (2010a) or NOAA-NMFS (2010) Suspected or Recorded in Upper Cook Inlet Project Area

<i>Common Name</i>	<i>Scientific Name</i>	<i>ESA Status</i>	<i>Location Description</i>
Beluga Whale (Cook Inlet Distinct Population Segment [DPS])	<i>Delphinapterus leucas</i>	Endangered	Occupies Cook Inlet waters including Knik Arm and waters of North Gulf of Alaska (NMFS 2008a)
Steller Sea Lion* (Western AK DPS)	<i>Eumetopias jubatus</i>	Endangered	Includes sea lions born on rookeries from Prince William Sound westward (NMFS 2008b).
Steller's Eider*	<i>Polysticta stelleri</i>	Threatened	Occurs in northern and western Alaska (USDI 2007).
Yellow-billed Loon*	<i>Gavia adamsii</i>	Candidate	Nest near freshwater lakes in the arctic tundra and winter along the Alaskan coast to the Puget Sound (USDI 2009a).
Kittlitz's Murrelet*	<i>Brachyramphus brevirostris</i>	Candidate	Nest near glaciers in rocky slopes near Gulf of Alaska waters, winters off shore in Gulf of Alaska (USDI 2010b)
Northern Sea Otter Southwest Alaska DPS*	<i>Enhydra lutris kenyoni</i>	Threatened	Alaska Peninsula to the western Aleutian Islands. The nearest Management Unit [Kodiak, Kamishak Alaska Peninsula (KKAP)] includes the western shore of the lower Cook Inlet south of the project area USFWS 2010c).
Chinook salmon*: Lower Columbia River (spring) Puget Sound Snake River (spring/summer) Snake River (fall) Upper Columbia River (spring)	<i>Onchorhynchus tshawytscha</i>	Threatened Threatened Threatened Threatened Endangered Threatened	These stock range throughout the North Pacific. However, the specific occurrence of listed salmonids within close proximity to Elmendorf AFB is highly unlikely (NMFS 2010).

**Threatened, Endangered, and Candidate Species Identified by
USFWS (2010a) or NOAA-NMFS (2010) Suspected or Recorded in
Upper Cook Inlet Project Area**

<i>Common Name</i>	<i>Scientific Name</i>	<i>ESA Status</i>	<i>Location Description</i>
Upper Willamette River			
Steelhead*: Lower Columbia River Middle Columbia River Snake River Basin Upper Columbia River Upper Willamette River	<i>Onchorhynchus mykiss</i>	Threatened Threatened Threatened Endangered Threatened	These stock range throughout the North Pacific. However, the specific occurrence of listed salmonids within close proximity to Elmendorf AFB is highly unlikely (NMFS 2010).

Note:

* May potentially move on or within close proximity to base, but occur so infrequently that projects are expected to have no effect on them (USFWS 2010a, NMFS 2010).

1.5 Threatened, Endangered, and Candidate Species Recorded in Anchorage/Upper Cook Inlet Area

1.5.1 Beluga Whale, Cook Inlet Distinct Population Segment (DPS)

Biology: See “National Marine Fisheries Service. 2008a. Conservation Plan for the Cook Inlet beluga whale (*Delphinapterus leucas*). National Marine Fisheries Service, Juneau, Alaska. 122 pages.”

Status: Endangered (Dec 2008) (73 FR 62919)

Critical Habitat: Proposed (74 FR 63080) December 2, 2009 but no final rule as of December 20, 2010. Area 1 of the proposed CH includes Knik Arm.

The primary constituent elements identified in the Proposed Critical Habitat Rule as “essential to the conservation of Cook Inlet beluga whales” are:

- Intertidal and subtidal waters of Cook Inlet with depths <30 feet (MLLW = Mean Lower Low Water) and within 5 miles of high and medium flow anadromous fish streams.
- Primary prey species consisting of four (4) species of Pacific salmon (Chinook, sockeye, chum, and coho), Pacific eulachon, Pacific cod, walleye pollock, saffron cod, and yellowfin sole.
- The absence of toxins or other agents of a type or amount harmful to beluga whales.
- Unrestricted passage within or between the critical habitat areas.
- The absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales.” (74 FR 63095, December 2, 2009)

Local Records: Population estimates by NMFS for the Cook Inlet beluga whale have totaled fewer than 400 individuals during the period 2001-2010; the 2010 estimate is 340 individuals (NMFS 2010b). Individuals/groups are seasonally common in Knik Arm waters adjacent to JBER from May to November. Cook Inlet belugas seasonally concentrate at mouths of anadromous fish streams where they feed on Pacific salmon (five species) and Pacific eulachon.

Other diet items include cod, pollock, and sole. In Knik Arm, belugas transit between locations such as stream mouths (NMFS 2010c) where behaviors including milling, feeding, and socializing by belugas have been identified (Stewart 2010). In the project area these areas include Six Mile Creek, North Eagle Bay, Eagle River, and near Point McKenzie, with transit of belugas primarily along the east side of the Lower Knik Arm (Stewart 2010). Most beluga activity in Knik Arm is noted during August, September, and October, coinciding with the Coho salmon run (NMFS 2010b). Within Knik Arm, beluga abundance is highly variable. Fourteen years of aerial surveys conducted during the first weeks of June by NMFS show beluga abundance in Knik Arm ranging from 224 (in 1997) to 0 whales (in 1994 and 2004) (NMFS 2008a). Beluga abundance in the Knik Arm is highest during the months of August through November, which account for 90 percent of observations of whales in the Knik Arm made by land and boat-based observations between July 2004 and July 2005 (NMFS 2010b). Surveys conducted by boat during August through October 2004 reported variable abundance counts in Knik Arm with 5-130 whales in August, 0-70 whales in September, and 0-105 whales in October (Funk et al. 2005). (Single observation totals of up to 71 whales during daily visits were recorded during summer 2009 in Eagle Bay at the mouth of Eagle River on JBER-Richardson (C. McKee, personal communication, USARG-DPW). Average daily visits to Eagle Bay were 9 whales (McKee and Garner 2010). These animals are expected to pass by JBER shorelines. Public observations suggest occasional feeding activity near mouth of Six Mile Creek, which is supported by studies conducted by Funk et al. (2005) and Stewart (2010.) The waters of Knik Arm are extremely turbid and subject to wide tidal fluctuations, with a mean diurnal range of 30 feet in Anchorage resulting in currents ranging from about 3 knots to 12 knots locally (Blackwell and Greene 2002). Belugas ascend to upper Knik Arm on the flooding tide and often retreat to lower portions of the Arm during low tides. In the narrows of the lower reaches of Knik Arm they tend to follow the tide within 1 km of either shoreline. Above the narrows, they may travel up the east side of the Knik Arm following the channel along Eagle Bay on incoming tides and belugas are observed to hug the western shoreline when moving out of the Knik Arm (NMFS 2010b); however, from vantage points on the east side of the Arm above the narrows, many of the same individuals observed swimming up on the east side are also observed to swim down on the same side (Garner, personal communication 2011).

1.5.2 Steller Sea Lion, Western DPS

Biology: See “National Marine Fisheries Service. 2008. Recovery Plan for the Steller Sea Lion (*Eumetopias jubatus*). Revision. National Marine Fisheries Service, Silver Spring, MD. 325 pages.”

Status: Endangered (1997) (62 FR 24345, 62 FR 30772).

Critical Habitat: Designated August 27, 1993 (58 FR 45269) – none in Upper Cook Inlet.

Local Records: Steller sea lions have been observed in Knik Arm on rare occasions – most recently a single male was observed during summer of 2009 near the mouth of Eagle River, adjacent to Eagle River Flats (C. McKee, personal communication, JBER USARG-DPW). NMFS (2010b) indicates that there is little likelihood that the species would enter the Knik Arm in the vicinity of JBER in the future.

1.5.3 Steller's Eider, Alaska Breeding Population

Biology: See "U.S. Fish and Wildlife Service. 2003. Steller's Eider Recovery Plan. Fairbanks, Alaska. 29 pages."

Status: Threatened (1997) (62 FR 31748 31757).

Critical Habitat: Designated 2001 (66 FR 8849 8884) – none in Upper Cook Inlet.

Local Records: Steller's eider noted as a casual visitor to Anchorage area in Anchorage Audubon bird checklist suggesting less than 10 total records. USFWS (2010d) indicates the distribution during winter and migration includes the shorelines of Cook Inlet, below Knik Arm.

1.5.4 Yellow-billed Loon

Biology: See "USDI Fish and Wildlife Service. 2009b. Endangered and Threatened Wildlife and Plants; 12-Month Finding on a Petition to List the Yellow-Billed Loon as Threatened or Endangered. 150 pp."

Status: Candidate –Priority 8 (2009) (74 FR 57803 57878).

Critical Habitat: None designated.

Local Records: Unsubstantiated observation on Green Lake, JBER during 2001 by A. Richmond. Not listed on Anchorage Audubon Bird Checklist.

1.5.5 Kittlitz's Murrelet

Biology: See "Alaska Seabird Information Series. 2006 Available at <http://alaska.fws.gov/mbssp/mbm/seabirds/pdf/kimu.pdf>. Also: "Draft Spotlight Species Action Plan" U.S. Fish and Wildlife Service. August 4, 2009 Available at: http://alaska.fws.gov/fisheries/endangered/pdf/kittlitzs_murrelet_draft_plan.pdf http://ecos.fws.gov/docs/candforms_pdf/r7/B0AP_V01.pdf and: Birdlife International Fact Sheet. Available at: <http://www.birdlife.org/datazone/speciesfactsheet.php?id=3310>

Status: Candidate–Listing Priority 2 (2008) (74 FR 57803 57878).

Critical Habitat: None designated.

Local Records: Most of Cook Inlet, including Knik Arm, is outside areas identified as nesting areas, non-breeding concentrations, and breeding concentrations (U.S. Fish And Wildlife Service Species Assessment And Listing Priority Assignment Form. May 2010. Available at: http://ecos.fws.gov/docs/candforms_pdf/r7/B0AP_V01.pdf, information current as of May 2010).

1.5.6 Northern Sea Otter—Southwest Alaska DPS

Biology: See Southwest Alaska DPS of the Northern Sea Otter (*Enhydra lutris kenyoni*) Draft Recovery Plan (August 2010) available at http://alaska.fws.gov/fisheries/mmm/seaotters/pdf/draft_sea_otter_recovery_plan_small_file.pdf

Status: Threatened.

Critical Habitat: Designated critical habitat exists in the west side of the lower Cook Inlet (outside the project area): (<http://alaska.fws.gov/fisheries/mmm/seaotters/pdf%5CSeaOtterCriticalHabitatMaps.pdf>)

Local Records: This species is not known to occur in the Upper Cook Inlet including Knik Arm (USFWS 2004). The project area is outside designated Critical Habitat for the Northern Sea Otter southwest Alaska DPS. Unit 5 (Kodiak, Kamishak, Alaska Peninsula) of Designated Critical Habitat is present on the western side of the lower Cook Inlet as far north as Redoubt Point, which is well to the south of Knik Arm. (<http://alaska.fws.gov/fisheries/mmm/seaotters/pdf%5CSeaOtterCriticalHabitatMaps.pdf>).

1.6 Effects Analysis

1.6.1 Cook Inlet Beluga Whale

Potential effects to Cook Inlet beluga whales include potential behavioral responses to the overflight of F-22s. Animals may react to the sound of the jet aircraft or the visual stimulus of the aircraft being overhead by avoiding the area or altering their natural behavior patterns, which could constitute behavioral harassment. Beluga whales are known for the variety of their vocalizations and have good hearing sensitivity at medium to high frequencies (see Appendix 2). The following analysis and discussion focuses on the potential effects on belugas from overflight by F-22s.

The additional F-22s associated with the proposed Plus-Up would contribute an approximate 21 percent increase in F-22 sorties from JBER. Approaches and departures would follow previously established and defined approach and departure patterns from JBER that are currently in use by F-22s. The action area for this analysis encompasses portions of the Knik Arm that are overflown by F-22 aircraft on established approach, departure, and reentry patterns. These portions of Knik Arm are located to the west and north of JBER runways. Figures 2 through 8, presented in Section 1.6.1.2 below, encompass the Action Area. A detailed analysis of noise associated with F-22 sorties following these patterns has been conducted for this assessment and is presented in Appendix 1. Some background information and a summary of the analysis are provided here.

1.6.1.1 Aircraft Overflight Noise Background

Sound is transmitted from an airborne source to a receptor underwater by four principal means:

- (1) Direct path, refracted upon passing through the air-water interface;

- (2) Direct-refracted paths reflected from the bottom in shallow water;
- (3) Lateral (evanescent) transmission through the interface from the airborne sound field directly above; and
- (4) Scattering from interface roughness due to wave motion.

Aircraft noise is chiefly transmitted from air into the water within a narrow band centered on the flight path. A large portion of the acoustic energy is reflected from the air-water interface during transmission of sound from air to water. For an overhead sound source such as an aircraft much of the sound at angles greater than 13 degrees from the vertical is reflected and does not penetrate the water. The area of maximum transmission can therefore be visualized as a 13-degree cone (26-degree aperture) with the aircraft at its apex (see Figure 1). Aircraft will be audible for longer as they climb and the base of the cone increases, however the acoustic energy reaching the water surface diminishes with increasing altitude of the aircraft. Outside the conical area of maximum transmission, sound may be reflected back into the air or transmitted shallowly into the water where it stays near the surface, but could be heard by an animal on or near the surface outside the cone.

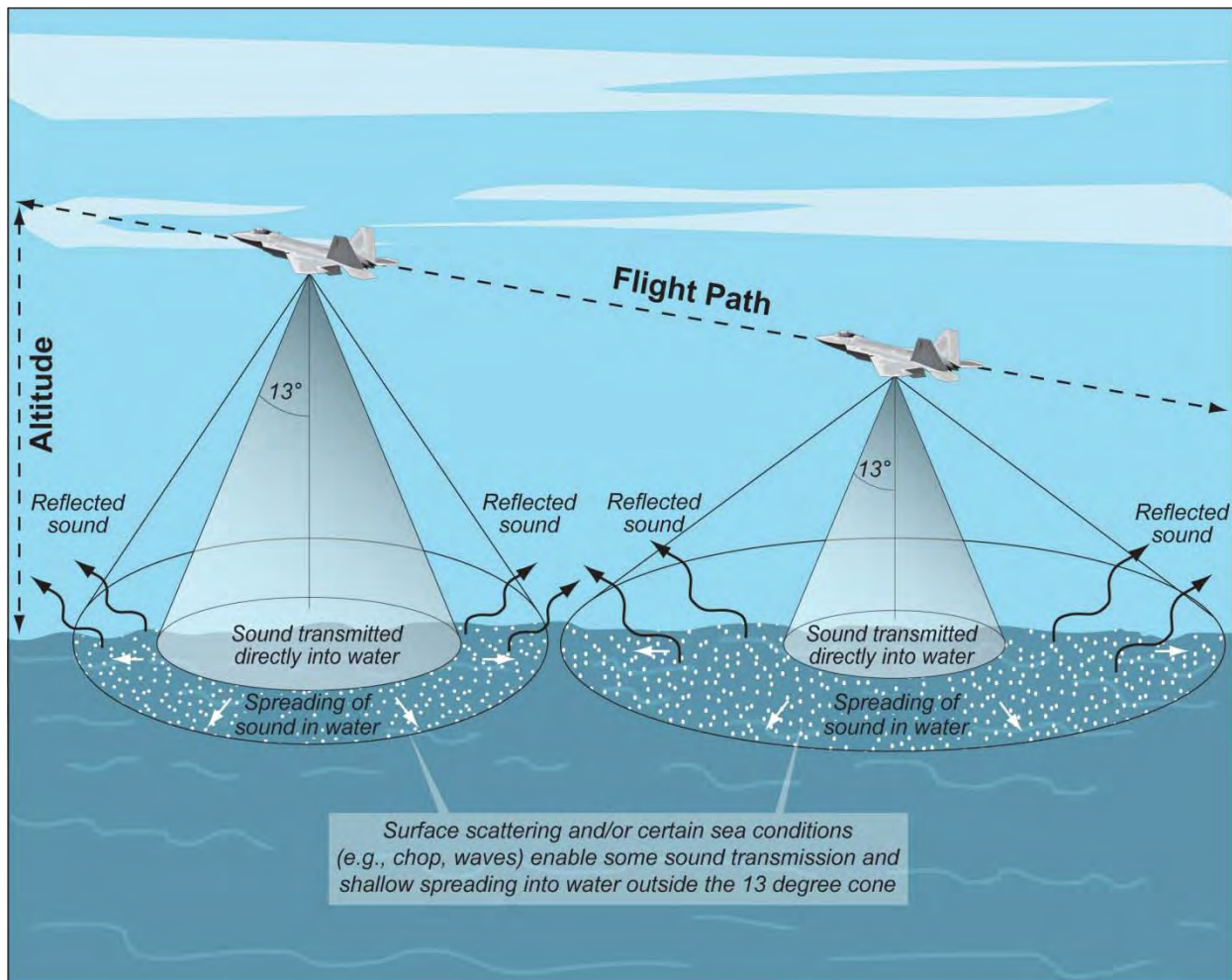


Figure 1. Aircraft noise transmission into water

Most sound is actually transmitted to water within the 13-degree “cone”, especially in calm conditions. Outside the cone most sound is reflected except where appropriately oriented faces of waves and chop enable some sound to be transmitted across the air-water interface. The sound that penetrates outside the cone does not penetrate deeply. The analysis conducted for this project described in Appendix 1 and below treats the area ensonified as if the cone didn’t exist. This simplifying assumption results in an overstatement of the amount of noise transmitted into the water from the air-water interface and results in an overestimation of the area affected by elevated noise levels in the water.

Exposures to elevated noise levels from aircraft overflight would be brief in duration (seconds) as the aircraft passes overhead and would diminish rapidly due to the speed of the aircraft. For example, Blackwell and Greene, in their study of underwater noise in the Cook Inlet near Elmendorf AFB (2002, Figure 3C), found that a landing F-15 passing directly overhead only generated underwater noise levels exceeding the ambient noise level for approximately three seconds. The exposed animal would need to be nearly directly underneath the overflight in order to be exposed to elevated noise levels from an aircraft overflight due to lack of or greatly diminished transmission of sound into water at angles greater than 13 degrees from the vertical. Furthermore, a noise would generally need to be louder than ambient (background) noise levels in order to be perceived by the animal.

Blackwell and Greene (2002) also measured high ambient noise levels in the Knik Arm. They found a 119 dB re 1 μ Pa average in-water reading adjacent to Elmendorf AFB while no overflights were taking place. The same investigators measured ambient noise of 124 dB re 1 μ Pa at Point Possession (a nearby locality south of Anchorage) during a changing tide. An EA for the Port of Anchorage reported noise levels on shipping days averaged 134–143 dB re 1 μ Pa and the Knik Arm Bridge EIS (Underwater Measurements of Pile-Driving Sound) reported background levels of 115–133 dB re 1 μ Pa. Additionally, KABATA *et al.* (2010) summarized a variety of existing noise studies conducted within the Knik Arm and concluded that measured background levels rarely are below 125 dB re 1 μ Pa, except in conditions of no wind and slack tide. Ambient noise energy in the Knik Arm is typically concentrated at frequencies below 10 kHz (Blackwell and Greene 2002).

Of F-15 aircraft overflights measured in air and in water while on approach for landing at Elmendorf AFB by Blackwell and Greene (2002), the sounds of overflight were detectable in water in only two of the eleven overflights, one at 90 degrees (i.e., directly overhead) and one at 80 degrees overhead. The peak in-water noise measured was 134 dB re 1 μ Pa for the F-15 landing straight overhead; the second measured overflight (at 80 degrees overhead) was 122 dB re 1 μ Pa. The sounds from the remainder of the overflights could not be detected in the water. The authors attributed this to two factors, angles exceeding 13 degrees from vertical, which reduces penetration of sound energy into the water, and high ambient in-water noise. For those events where aircraft noise was detectable in the water, it was only detectable for approximately 3 seconds.

F-22 aircraft have been based at JBER since 2007, when F-22s replaced the F-15E and one of the F-15C squadrons that had been based at JBER. In 2010, the last remaining F-15 squadron departed JBER, leaving the F-22 as the only fighter aircraft based at JBER. F-22 engines are more powerful than those used in F-15 aircraft, and have the potential to be louder than engines of

F-15C or F-15E aircraft that had been present at Elmendorf AFB at the time the measurements by Blackwell and Greene (2002) described above were made. However, two operational factors reduce the differences in noise levels between the two aircraft types with regard to overflight of the Knik Arm under normal circumstances. These are: (1) faster rate of climb of the F-22, causing it to be at higher altitude when it overflies the Knik Arm during departures and (2) lower power settings required by the F-22 than for the F-15 on approach and when landing. It is interesting to note that in-water F-15 noise levels reported in the Blackwell and Greene study are only slightly less than estimated in-water F-22 noise levels predicted in this analysis (see Appendix 1). This result fits expectations given the characteristics of the two aircraft. Jet aircraft noise, which is generated primarily by turbulent mixing of air, is concentrated in relatively low frequency bands, primarily below 4,000 Hz (= 4 kHz – Wyle Labs 2001, see also Appendix 1, Figure 2). Spectral characteristics of F-22 noise in water have not been measured, but are expected to be similar to dominant ambient noise sources in the Knik Arm.

1.6.1.2 Potential Overflight Effects

The additional F-22 overflights would produce airborne noise and some of this energy would be transmitted into the water. Cook Inlet beluga whales could be exposed to noise associated with the additional F-22 overflights while at the surface or while submerged. In addition to sound, marine mammals could react to the shadow of a low-flying aircraft.

Exposure to F-22 aircraft noise would be brief (seconds) as an aircraft quickly passes overhead. Most observations of cetacean responses to aircraft overflights [(e.g., diving, slapping the water with flukes, swimming away from track of low-flying survey aircraft (Richardson *et al.* 1995)] are from aerial scientific surveys that involve aircraft flying at relatively low altitudes (frequently below 200 ft. MSL) and low airspeeds, often with repeated passes or circling. It should be noted that most of the aircraft overflight exposures analyzed in the studies reviewed by Richardson *et al.* (1995) are different than F-22 overflights. Compared to F-22s overflying the Knik Arm while approaching or departing from JBER, survey and whale watching aircraft are expected to fly at lower altitudes and exposure durations would be longer for aircraft intending to observe or follow an animal or group of animals.

The visual aspect of an F-22 overflight over the Knik Arm would be minimal, because of its altitude, small size, and rapidity of the overflight. The F-22's closest approach to the water surface ranges from 653 to 4295 feet MSL, depending on the flight procedure being conducted (data in Appendix 1, Table 1). Based on the annual use of the different flight paths, the weighted average of closest approach to water is 2,250 feet MSL for all flight paths.

As reported by F-22 pilots during interviews, airspeeds when crossing the Knik Arm range from 160 to 350 knots. Reported airspeeds were used to calculate time spent over Knik Arm in configurations that generate >120 dB SPL. The total time per flight event in flight configurations that result in underwater noise levels >120 dB SPL over the Knik Arm is between 26 and 163 seconds with the number of seconds depending on the flight procedure being conducted. Due to the F-22's airspeed, at any given point within the overflowed portion of Knik Arm, exposures to underwater noise levels >120 dB SPL would be very brief—in the neighborhood of 2-5 seconds. Consecutive overflights (e.g., “two-ship” departures) could cause the period of exposure to noise level >120 dB SPL to be longer (e.g., up to about 10 seconds).

The visual experience of an F-22 overflight would be similar to that of an F-15 overflight. The F-22 is 62 ft long with a 44-foot wingspan and is similar in size to an F-15C or F-15E. Altitude profiles for the two aircraft are similar during arrival operations. During departure operations, the F-22 climbs more quickly than the F-15, resulting in the F-22 being at higher altitudes while overflying the Knik Arm. Airspeeds in the runway vicinity are similar for the two aircraft meaning that the duration of the visual experience is similar. Because of its altitude, small size, and rapidity of the overflight, adverse visual behavioral response to F-22 overflight on established flight tracks over Knik Arm is not expected.

A variety of effects may result from exposure to sound-producing activities. The severity of these effects can vary greatly between minor effects that have no realizable cost to the animal, to more severe effects that may have lasting consequences. Potential acoustic effects to marine mammals fall into five major categories: 1) Direct Trauma; 2) Auditory Fatigue; 3) Auditory Masking; 4) Stress Response; and 5) Behavioral Reactions.

Direct trauma refers to injury to organs or tissues of an animal as a direct result of an intense sound wave or shock wave impinging upon or passing through their body. This has only been shown with close proximity to very intense sources such as explosions. Auditory fatigue may result from overstimulation of the delicate hair cells and tissues within the auditory system. The maximum sound pressure level predicted within the water is 137dB re 1 μ Pa for a duration of a few seconds (see noise modeling calculations below and in Appendix 1). A temporary hearing loss (temporary threshold shift [TTS]) threshold of 195 dB re 1 μ Pa²-s is primarily based on the cetacean TTS data from Schlundt et al. (2000) and corroborated by the short-duration tone data of Finneran et al. (2001, 2003, 2005) and the long-duration sound data from Nachtigall et al. (2003a, b). This is the best threshold to predict temporary hearing loss for non-impulsive sound, which is the lowest order direct physiological effect (with the exception of stress). An animal would need to be exposed to 137 dB re μ Pa continuously for about 175 hours to reach the 195 dB re 1 μ Pa²-s sound exposure level threshold. Therefore direct trauma and auditory fatigue as a result of F-22 overflights are not predicted.

Auditory masking occurs when the perception of a sound is interfered with by a second sound and the probability of masking increases as the two sounds increase in similarity and the masking sound increases in level. The maximum predicted in-water sound from F-22 overflights is 137 dB re 1 μ Pa for a duration of a few seconds; during most flight operations and in most places under the flight path the maximum noise levels would be significantly less. As described above, ambient noise levels in the northern Cook Inlet and Knik Arm normally exceed 120 dB re 1 μ Pa. Therefore, since predicted F-22 overflight noise levels are often very close to ambient noise levels, and the noise would only be heard for a few seconds at any given point within the water, masking is not predicted.

Physiological stress and behavioral reactions may occur at the predicted in-water sound levels. The data to predict physiological stress based on specific sound levels do not exist for marine mammals. Therefore, the following analysis examines the possibility that F-22 overflights will cause a behavioral reaction (and possible physiological stress response) in Cook Inlet beluga whales. An analytical model was used to quantify potential behavioral disturbances based on predicted sound levels; thresholds derived from reactions of animals to similar intermittent, non-impulsive sounds; and Cook Inlet beluga whale density estimates. The most appropriate

acoustic threshold is currently the odontocete risk function which assesses the probability of a behavioral reaction from 120 dB SPL to 195 dB SPL for non-pulse sound as described in Appendix 1. The results of this model were studied and a number of contextual factors were considered to ascertain the potential effects of F-22 overflights on the beluga whales.

As described in Appendix 1, all established flight profiles used by F-22s at JBER were modeled, taking into account engine power settings, altitudes, and maneuvers at points along each flight track. These parameters were verified with F-22 pilots at JBER through interviews and follow-up questions during the week of 6 December 2010. Each of the flight profiles consists of multiple segments (i.e., initial approach to the airfield, circling to land, etc.). Each flight profile segment that overflies the Knik Arm was assessed for potential to impact beluga whales. Noise levels in air were calculated at increments along each flight path. Appropriate conversions were made to account for the transmission of sound across the air/water interface as described in Appendix 1 and the maximum in-water sound pressure levels associated with overflights were calculated. As stated above, maximum modeled in-water sound pressure levels (SPL) associated with F-22 overflight of the Knik Arm do not exceed 137 dB re 1 μ Pa (Appendix 1).

The threshold for potential effects was then established using the odontocete risk function, an “S”-shaped curve which assesses the probability of a behavioral reaction in the interval between 120 dB SPL to 195 dB SPL for non-pulse sound (see Appendix 1, page 2, and Appendix 1, Figure 1). The odontocete risk function as applied in this analysis was designed based on findings of several studies, including numerous individuals, and therefore takes into account variation among individuals in sensitivity to stimulus. Highly sensitive individuals (or groups) would have a slightly higher likelihood of behavioral response than indicated by the odontocete risk curve at a given received level and unusually insensitive individuals would have a slightly lower likelihood of behavioral response than indicated by the odontocete risk curve. Given this threshold range, all areas in which modeled in-water SPL exceeds 120 dB re 1 μ Pa at the loudest point were delineated and broken down into subareas or “bins” within which in-water SPLs ranged from 120-125 dB; 125-130 dB; and above 130 dB re 1 μ Pa, respectively. These were mapped for each type of flight path and their areas determined using GIS. The affected area was then multiplied by a value estimating beluga population density. We considered two density values, 0.08 beluga whales/km² and 0.12 beluga whales/km², and ultimately used the higher density in our calculations because it would yield a higher estimate of effect. The smaller value (0.08 beluga whales/km²) was the maximum monthly density of belugas calculated for the Knik Arm near JBER based on several monitoring studies (KABATA *et al.* 2010, Table 8). The larger density value was based on the current (2010) estimated Cook Inlet beluga whale population of 340 individuals (NMFS 2010b) divided by 2,800 km², the area estimated to represent 95 percent of the occupied Cook Inlet beluga whale range (Rugh *et al.* 2010), thus yielding a density estimate of 0.12 beluga whales/km².

The results are shown in Figures 2 through 8, which portray all flight profiles in which in-water SPLs were calculated to equal or exceed 120 dB. The F-22 flight profiles depicted in Figures 2 through 8 are named according to five character codes which are sometimes followed by a number (e.g. RAPTR, EEEGL2, and MATSU5) or according to the type of pattern being conducted (e.g., IFR approach, VFR re-entry). The legend of each figure contains the probability of behavioral effect, determined for the highest SPL in the range (e.g., 125 dB for the range 120-125 dB). For areas exceeding 130 dB SPL, the maximum probability of behavioral reaction from the odontocete risk function for the probability associated with 137 dB SPL was used. This was the highest modeled exposure for any flight path.

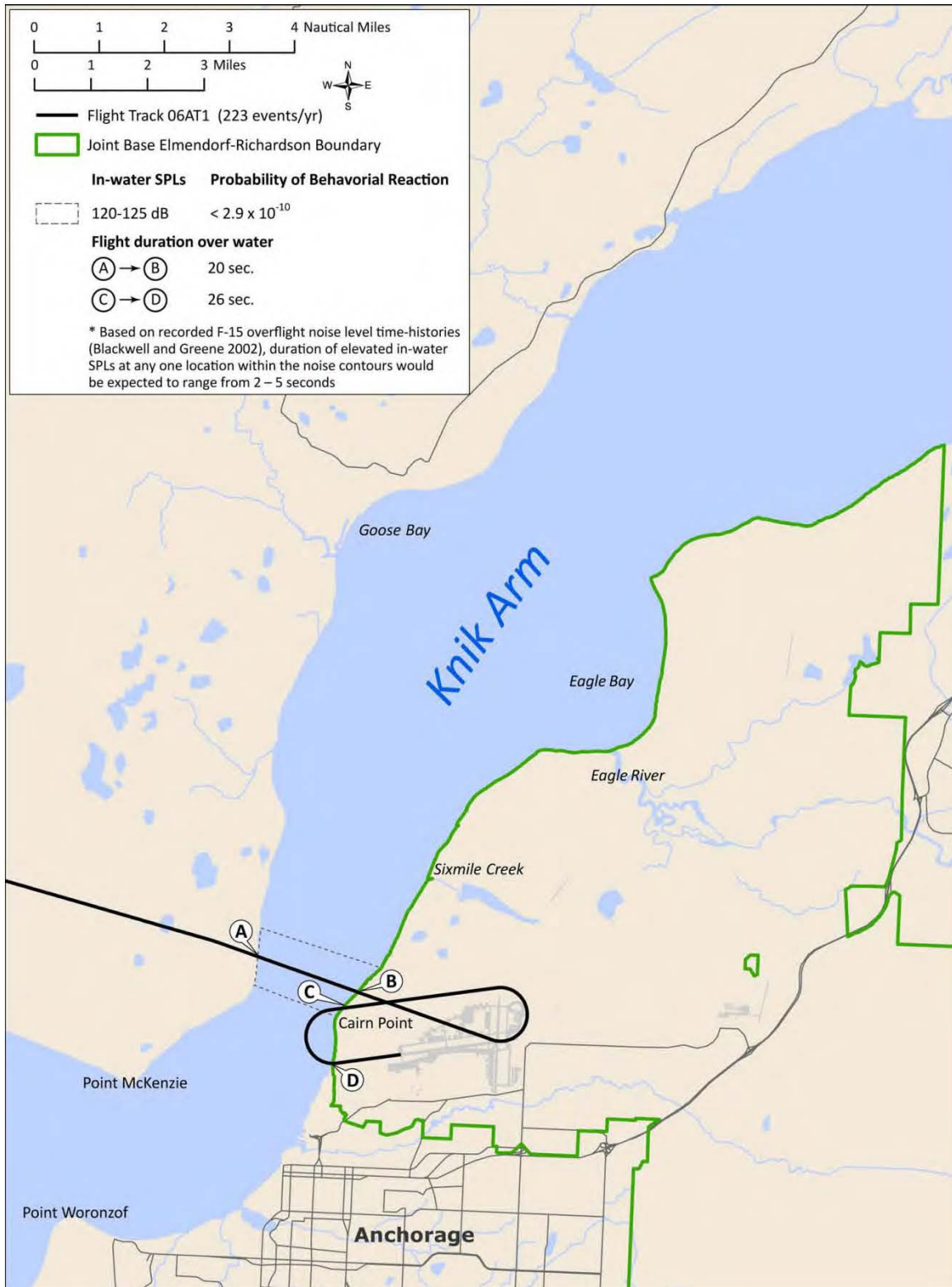


Figure 2. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on RAPTR Transition to Runway 06, Flight Lead (Track 06AT1), Initial Approach to Runway.

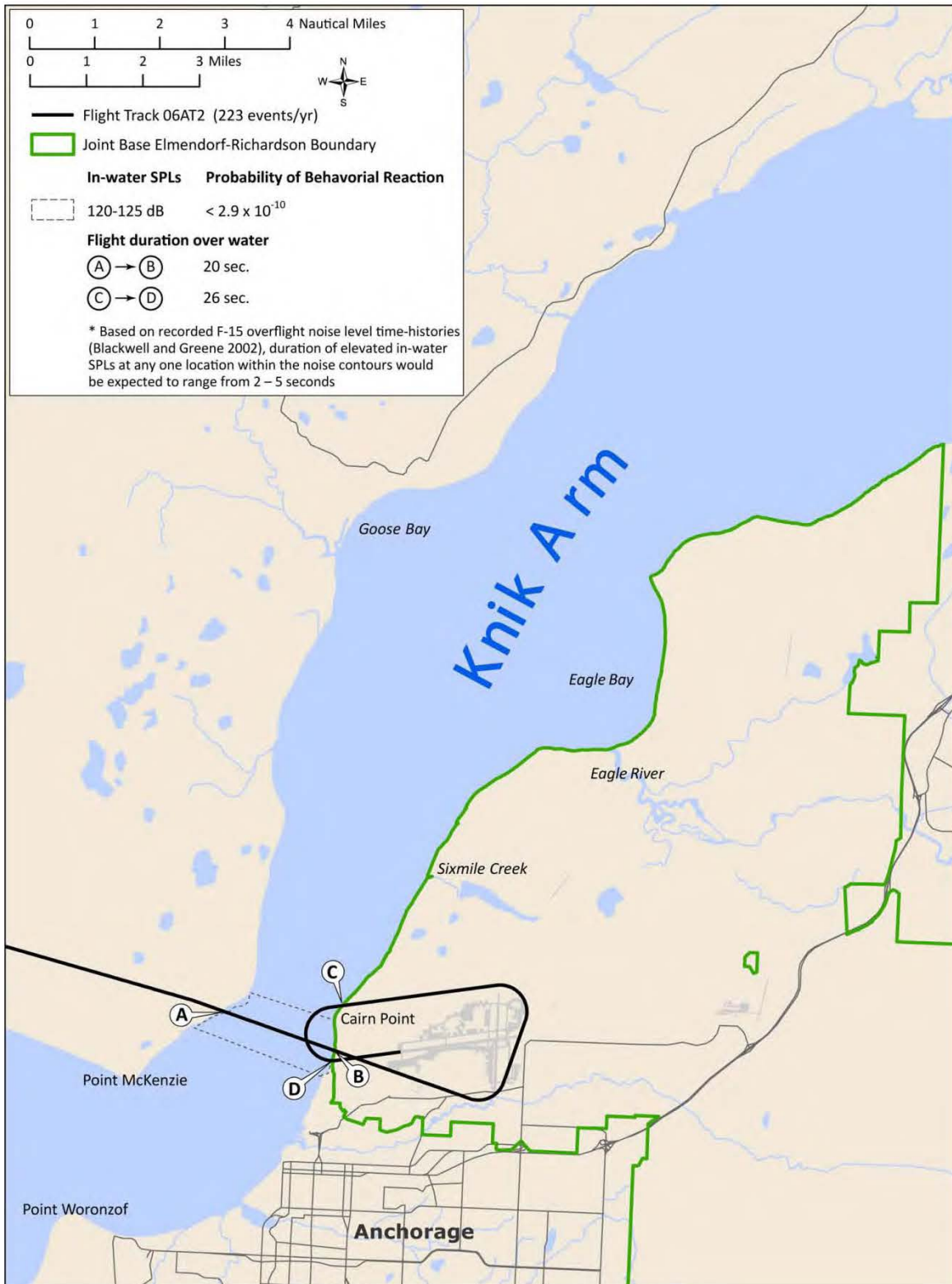


Figure 3. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on RAPTR Transition to Runway 06, Wingman (Track 06AT2), Initial Approach to Runway.

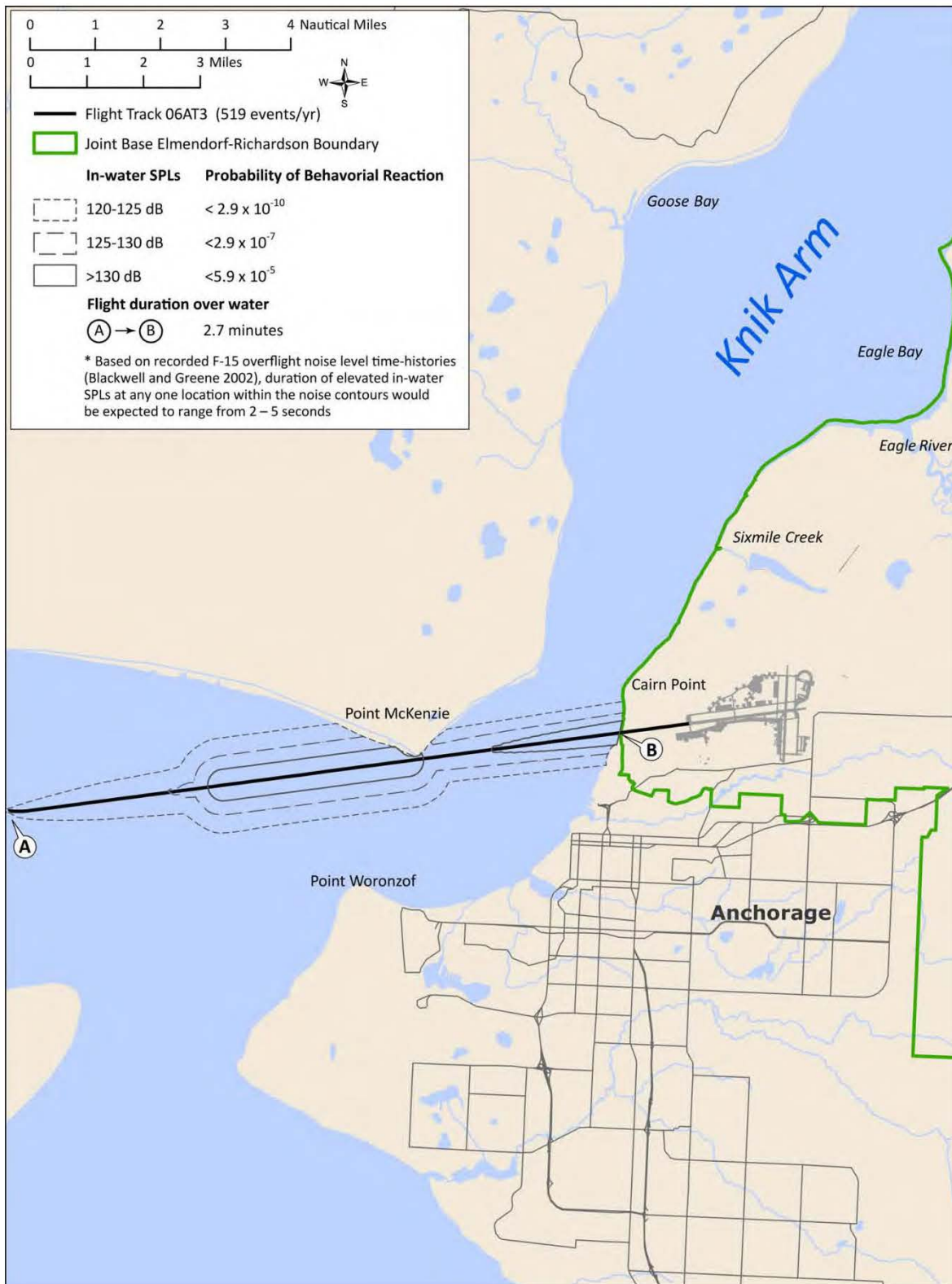


Figure 4. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on IFR Approach to Runway 06 (Track 06AT3), Arrival or Closed Pattern.

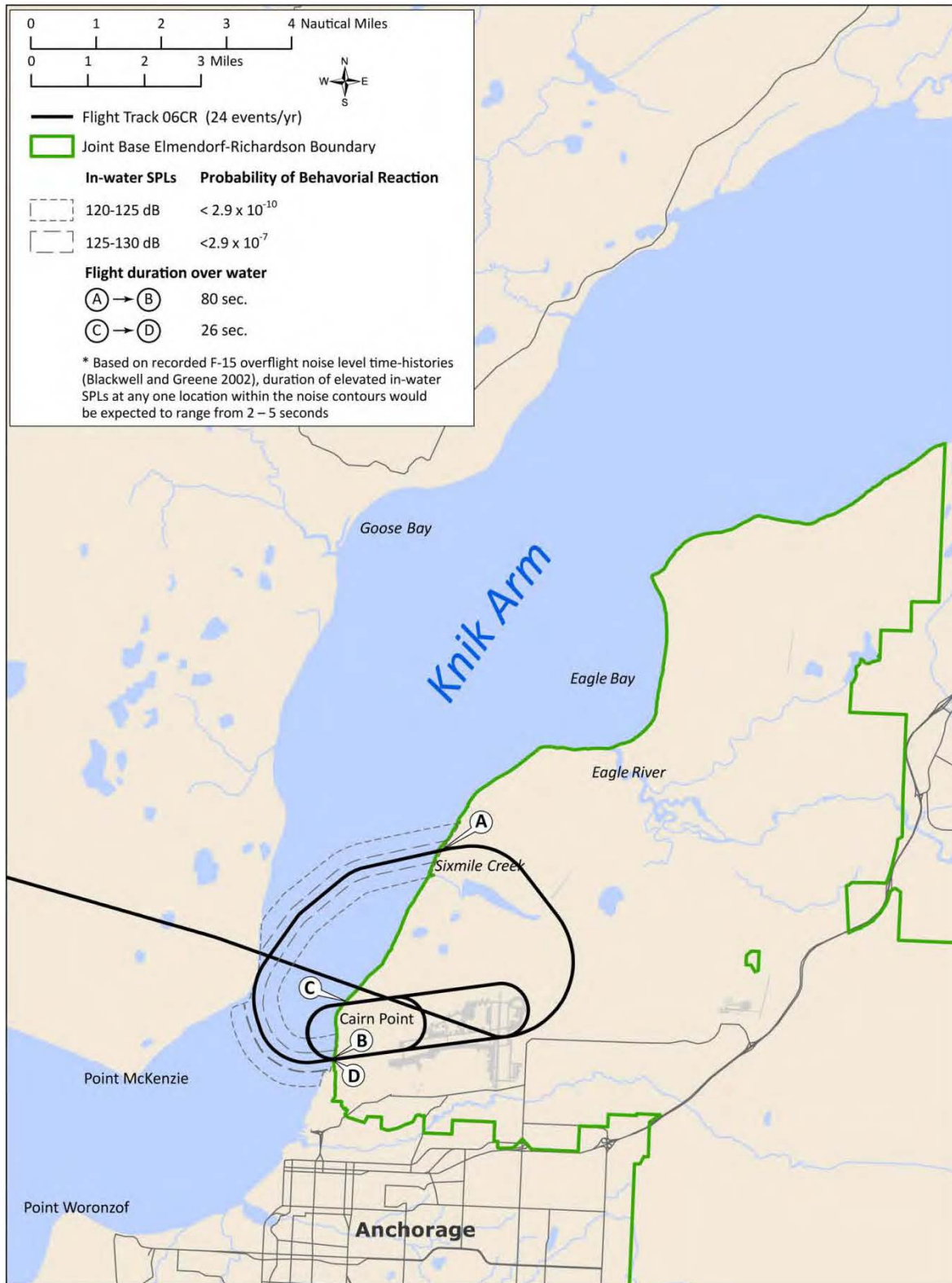


Figure 5. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on VFR Re-entry Pattern to Runway 06 (Track 06CR), Initial Approach to Runway.

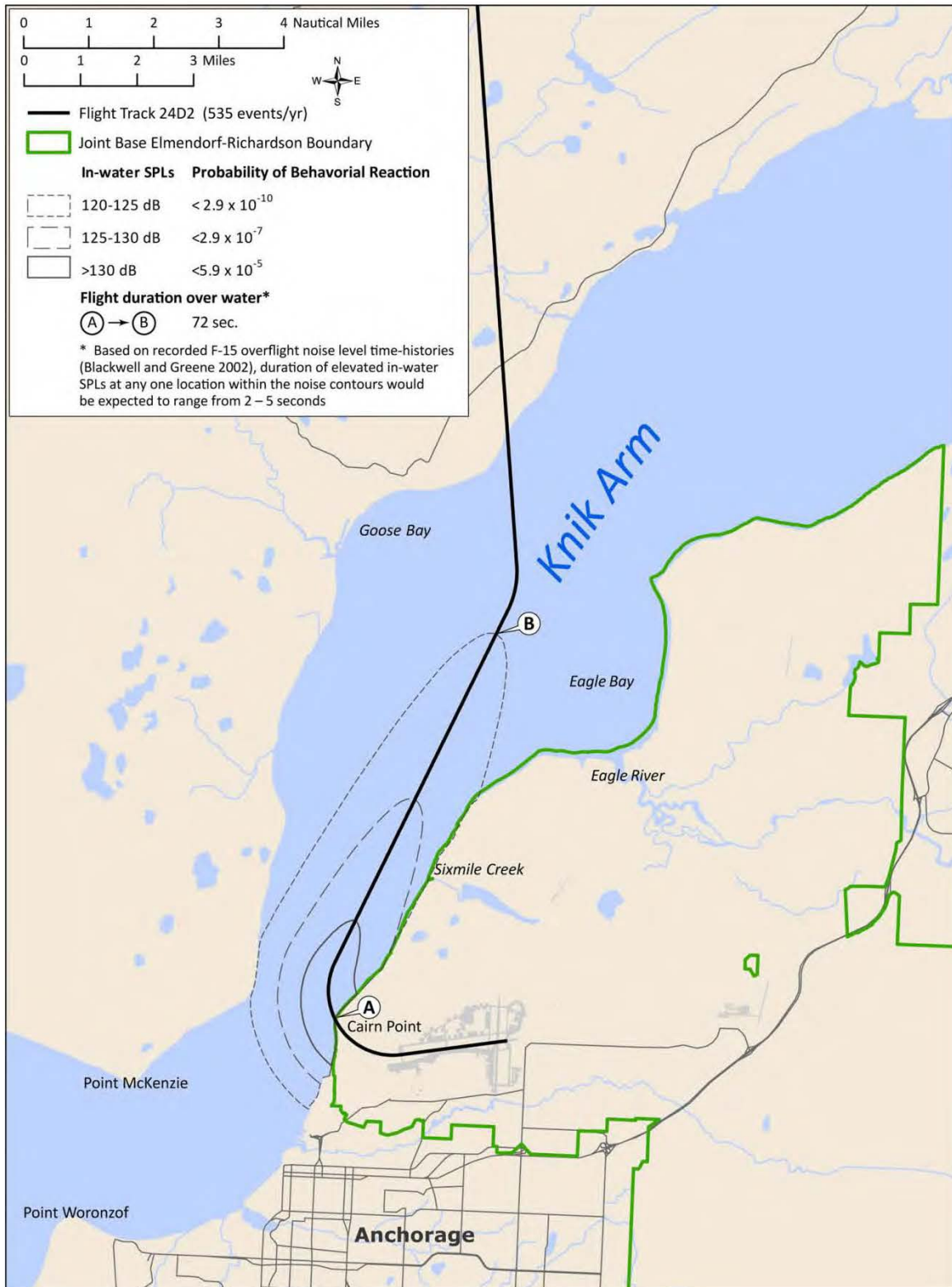


Figure 6. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on EEEGL2 Departure from Runway 24 (Track 24D2), Military or Afterburner Departure.

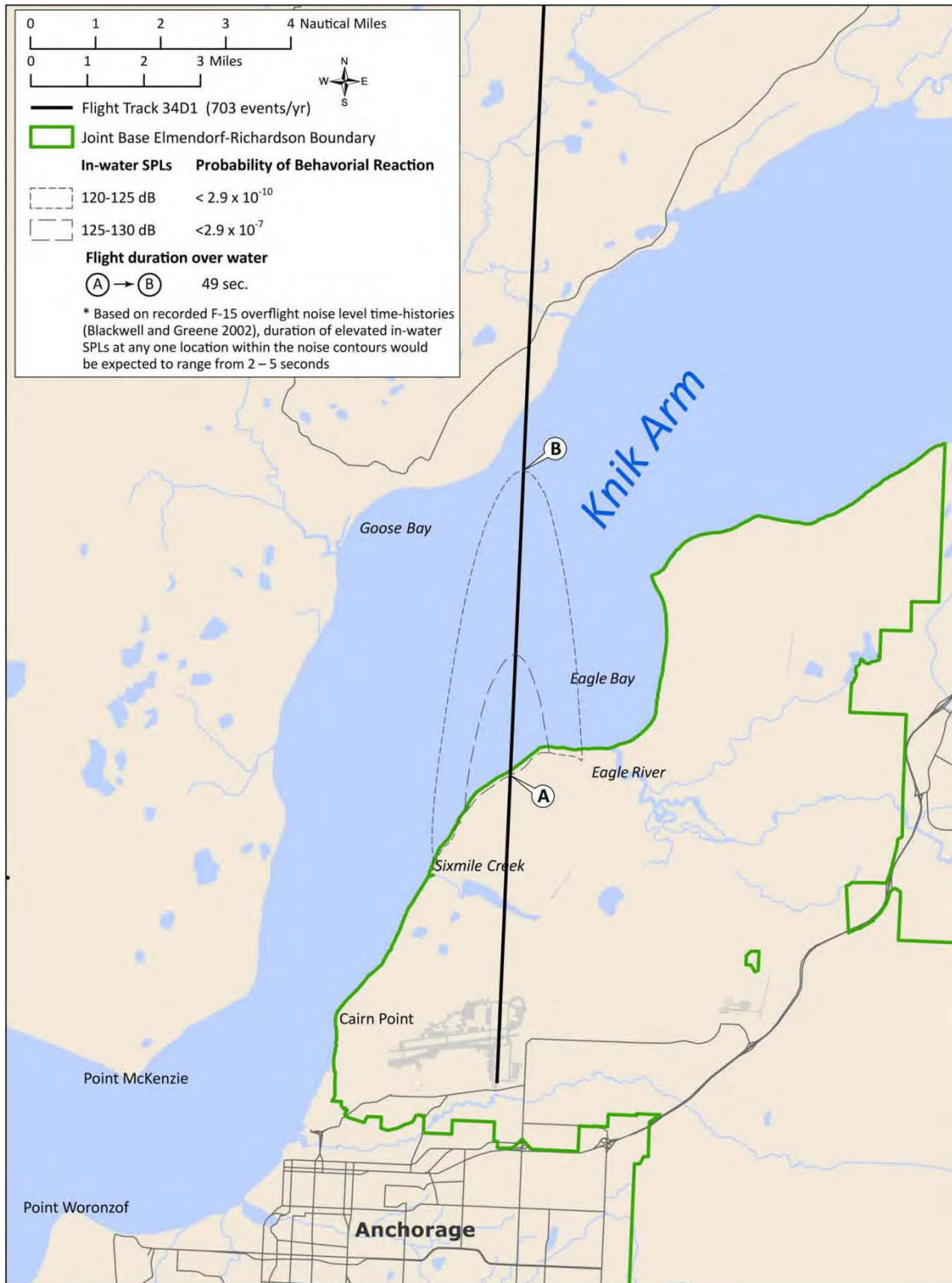


Figure 7. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on EEEGL2 Departure from Runway 34 (Track 34D1), Military Departure.

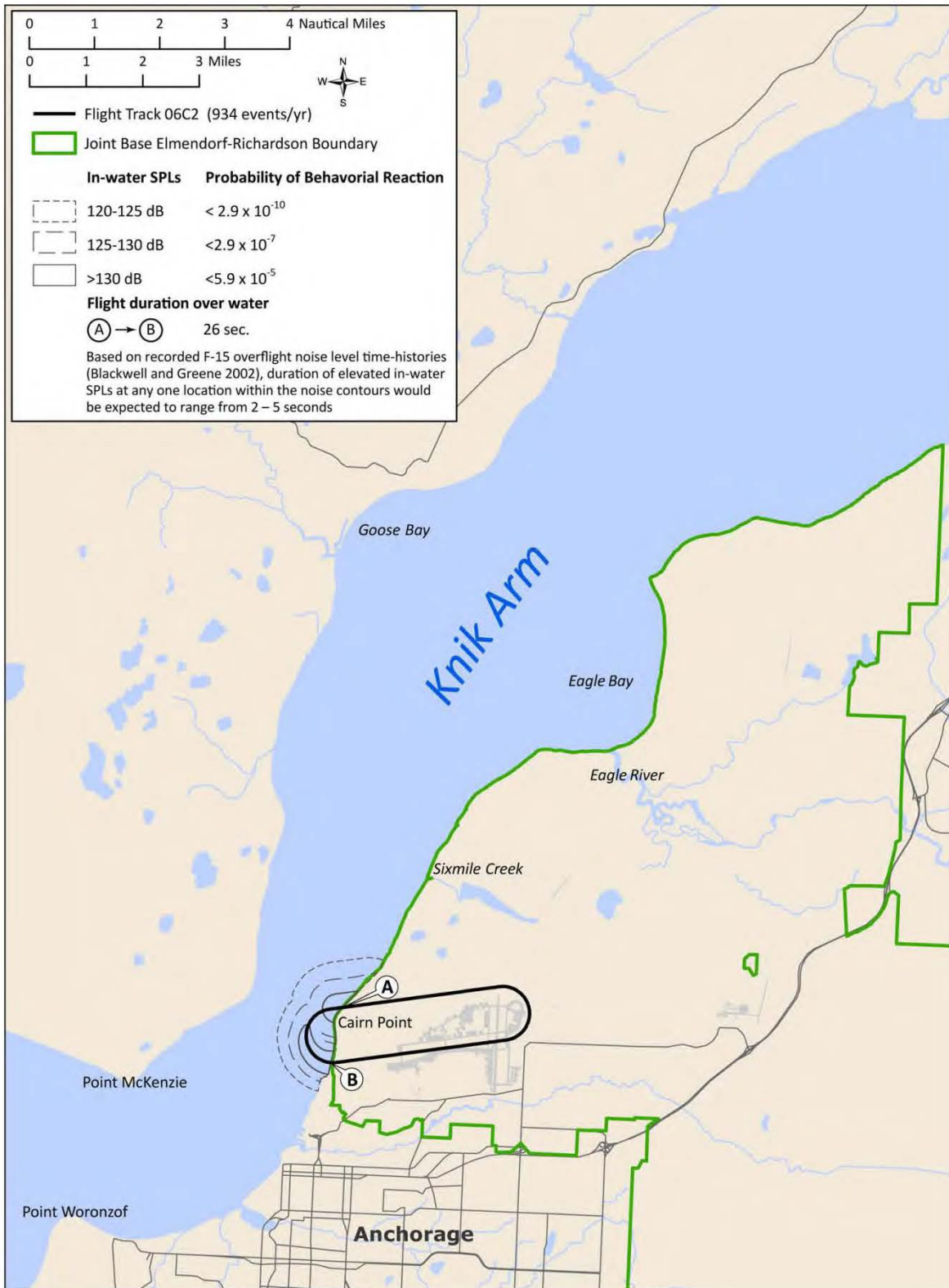


Figure 8. Water Surface Area Below Which Modeled Instantaneous In-Water Sound Pressure Levels Are 120 dB or Greater Resulting From F-22 Overflight on Overhead Pitch or Visual Closed Pattern to Runway 06 (Track 06C2).

As detailed in Appendix 1, the analysis was again conservative (i.e., overestimates effects), calculating the largest possible footprint of sound levels exceeding 120 dB. Much of the noise energy generated by jet aircraft is at low frequencies (below 10 kHz), which is below the best hearing range of belugas (30-80kHz). Overflights generally occur over portions of the lower Knik Arm where beluga whales are generally transiting when present (KABATA et al., 2010). The probability and consequences of altering a transiting animal's behavior are unknown, however biologically significant effects would be less likely than those associated with disturbing feeding or mating behavior. However, modeled noise levels of 120-125 dB associated with some flight tracks are predicted in the vicinity of the mouth of Six Mile Creek (Figures 5-7) and Eagle Bay (Figure 7), areas where belugas are known to feed and congregate. Given the regular occurrence of overflight of belugas by jet aircraft at Stevens International Airport and JBER, the brief duration of the exposure to elevated in-water noise (seconds, as described above), and the absence of direct physical harm or injury to belugas from overflight, there is potential for diminution of any behavioral response to overflight over time (habituation). Blackwell and Greene (2002) indicated this appears to be the case with belugas, which are thought to habituate and become tolerant of the vessels, when exposed to substantial boat traffic. Additionally, for animals to detect and respond to a noise it needs to be louder than background by greater than a value known as the critical ratio. Odontocete critical ratios are typically between 10 and 20 dB, with the actual value varying by frequency and species (Richardson *et al.* 1995). Given that measured in-water noise levels in the Knik Arm near JBER are frequently in the neighborhood of 120-125 dB re 1 μ Pa or more (NMFS 2010b; Blackwell and Greene 2002), it is possible that elevated in-water noise from overflights would not be perceived as a distinct noise source by the belugas because of the high levels of ambient in-water noise. The high levels of ambient noise are not accounted for in the analytical approach employed in this document (see Appendix 1) and this is another factor that may result in overestimation of the likelihood of behavioral reaction to overflights.

The resulting estimated number of behavioral reactions associated with the proposed action are less than 0.04 individuals per year (Appendix 1). Because the likelihood of behavioral reaction is essentially zero, it is so low as to be discountable and it is therefore concluded that the project may affect but is unlikely to adversely affect the Cook Inlet beluga whale.

The potential for project effects on the proposed critical habitat for Cook Inlet beluga whale was evaluated as summarized below with respect to the five Primary Constituent Elements (PCEs) in the proposed critical habitat (74 FR 63095, December 2, 2009). The PCEs are listed above in Section 1.5.1 of this report.

- (1) Because there would be no onshore or in-water construction, earth moving, or vegetation removal associated with the proposed F-22 plus-up, there would be no effects on the water quality or hydrology of waters of the Knik Arm or its tributaries.
- (2) Overflights by additional F-22s, including elevated sound levels, are not expected to affect prey species consumed by Cook Inlet beluga whales. In the Knik Arm project area, these primarily include four salmon species and Pacific eulachon; however Pacific cod, walleye pollock, saffron cod, and yellowfin sole are also taken. Salmon and most marine fish are hearing generalists with their best hearing sensitivity at low frequencies (below 300 Hz) where they can detect particle motion induced by low frequency sound at high intensities (Amoser and Ladich 2005; Popper and Hastings 2009), not

approached by projected sound levels associated with F-22 overflight. Studies of Atlantic salmon conclude that they are unlikely to detect sounds originating in air (Hawkins and Johnstone 1978). It is unlikely that the fish species listed as beluga prey would detect the noise from any jet overflights. If overflight sounds were detected by fish species, any effects would be short-term and minor, given the low projected sound pressure levels (maximum of 137 dB re 1 μ Pa), short duration, and intermittent nature of elevated in-water sound associated with F-22 overflight.

- (3) There would be no introduction of toxins or other agents of a type or amount harmful to beluga whales.
- (4) The project would not affect passage of beluga whales within or between critical habitat areas.
- (5) Based on the analysis in this report, there would be “absence of in-water noise at levels resulting in the abandonment of habitat by Cook Inlet beluga whales.”

Therefore the project is not expected to result in adverse modification of the proposed critical habitat for the Cook Inlet beluga whale.

In conclusion, although Cook Inlet beluga whales are likely to be present during some of the F-22 overflights, analysis of modeled underwater noise levels shows that exposure to projected in-water noise levels exceeding 120 dB re 1 μ Pa would be exceedingly unlikely to result in behavioral harassment. Therefore this proposal will have no indirect, cumulative or interdependent/interrelated effects in regards to Cook Inlet Beluga whale and would have no effect on its proposed critical habitat.

Determination: May affect not likely to adversely affect Cook Inlet Beluga Whale. No effect on Cook Inlet Beluga Whale proposed Critical Habitat, or its prey species.

1.7 Steller Sea Lion

- (1) This species is not expected to occur in the project area (NMFS 2010b) and the combined likelihood of its occurrence in the project area and being in the area of elevated noise levels from F-22 overflight is so low as to be discountable.
- (2) Therefore, this proposal will have no direct, indirect, cumulative or effect in regards to Western population of Steller sea lion or its habitat.
- (3) Determination: May affect not likely to adversely affect Steller sea lion.

1.8 Steller's Eider

- (1) This species is not expected to occur in the project area and the combined likelihood of its occurrence in the project area and being in the area of elevated noise levels from F-22 overflight is so low as to be discountable.
- (2) Therefore, this proposal will have no direct, indirect, or cumulative effects in regards to the Alaska breeding population of Steller's eider.
- (3) Determination: May affect not likely to adversely affect Steller's eider.

1.9 Yellow-billed Loon

- (1) This species is not expected to occur in the project area and the combined likelihood of its occurrence in the project area and being in the area of elevated noise levels from F-22 overflight is so low as to be discountable.
- (2) Therefore, this proposal will have no direct, indirect, or cumulative effects in regards to the yellow-billed loon.
- (3) Determination: May affect not likely to adversely affect the yellow-billed loon.

1.10 Kittlitz's Murrelet

- (1) This species is not expected to occur in the project area and the combined likelihood of its occurrence in the project area and being in the area of elevated noise levels from F-22 overflight is so low as to be discountable.
- (2) Therefore, this proposal will have no direct, indirect, or cumulative effects in regards to Kittlitz's murrelet.
- (3) Determination: May affect but not likely to adversely affect Kittlitz's murrelet.

1.11 Northern Sea Otter, Southwest Alaska DPS

- (1) This species is not expected to occur in the project area and the combined likelihood of its occurrence in the project area and being in the area of elevated noise levels from F-22 overflight is so low as to be discountable.
- (2) Therefore, this proposal will have no direct, indirect, or cumulative effects in regards Southwest Alaska DPS of the Northern Sea Otter.
- (3) Determination: May affect but not likely to adversely affect the Southwest Alaska DPS of the Northern Sea Otter.

1.12 Conclusion

A determination of "may affect not likely to adversely affect" is found for all species analyzed; therefore, no Sec 7 consultation is required for this project.

1.13 Additional Considerations

1.13.1 *Marine Mammal Protection Act (MMPA)*

All marine mammals are protected under the Marine Mammal Protection Act. Because behavioral reactions by beluga whales are not predicted (< 1 behavioral reaction per year) there would be no harassment of this species under MMPA. Other marine mammal species occasionally documented in the Knik Arm Project Area include Steller's sea lion (discussed above), harbor seal (*Phoca vitulina*), harbor porpoise (*Phocoena phocoena*), and killer whale (*Orcinus orca*). Their occurrences are infrequent and in much lower abundance in the Knik Arm than the Cook Inlet beluga whales. Potential project effects identified above for the beluga

whale are considered to be possible, but even less likely given the very low abundance of these species in the Knik Arm. Adverse effects associated with the proposed Plus-Up, including behavioral reactions to overflight, are not expected to occur for any marine mammal.

1.13.2 *Migratory Bird Treaty Act (MBTA)*

The Migratory Bird Treaty Act of 1918 (amended in 1936 and 1972) prohibits the taking of migratory birds, unless authorized by the Secretary of Interior. Executive Order 13186 (Responsibilities of Federal Agencies to Protect Migratory Birds) provides for the conservation of migratory birds and their habitats, and requires the evaluation of the effects of Federal actions on migratory birds, with an emphasis on species of concern. Federal agencies are required to support the intent of the migratory bird conventions by integrating bird conservation principles, measures, and practices into agency activities and by avoiding or minimizing, to the extent practicable, adverse impacts on migratory birds when conducting agency actions. The DoD has an exemption of the MBTA for training for military readiness. Although not directly for this project, a permit for take exists and is maintained in the Bird Exclusion Zone on JBER.

1.13.3 *National Environmental Policy Act (NEPA)*

This wildlife analysis has been prepared in conjunction with an F-22 Plus-Up Environmental Assessment (EA) being prepared by the United States Air Force (Air Force) to evaluate the potential environmental consequences of the proposal to add six primary and one back-up F-22 aircraft to the Joint Base Elmendorf-Richardson (JBER) F-22 inventory, an increase in primary aircraft of approximately 17 percent.

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APPENDIX 1. NOISE IMPACTS ASSESSMENT

METHODOLOGY AND QUANTITATIVE RESULTS

1.15 Introduction

This appendix describes a methodology for estimation of potential behavioral effects of Cook Inlet beluga whales (CIBW) associated with proposed increase in F-22 aircraft operations at Joint Base Elmendorf Richardson (JBER), AK associated with the addition of six primary aircraft and summarizes results of the analysis.

1.16 Methodology

The steps involved in predicting potential behavioral reactions are described below:

Step 1: Calculate Maximum *in-air* noise level associated with overflights. F-22 pilot interviews were held during the week of 6 December 2010 for the purpose of collecting detailed data on aircraft operations (i.e., engine power settings, altitudes, and airspeed at several points along each flight track). During the interviews, several flight profiles were developed which are representative of F-22 flying patterns at JBER. Each of the flight profiles consists of multiple segments (i.e., initial approach to the airfield, circling to land, etc.). Each flight profile segment that overflies the Knik Arm was assessed for potential to impact beluga whales. Event types were aggregated when the flight profile segment of two events were identical over the Knik Arm. For example, afterburner and non-afterburner departures are identical over the Knik Arm. Pilots turn off afterburner prior to reaching water and the altitude/power setting profiles and flight tracks describing these two event types are the same from that point onward.

Maximum A-weighted noise level reference 20 μ Pa ($L_{A_{max}}$ re 20 μ Pa) at sea level associated with each F-22 flight profile segment was calculated at the location over the Knik Arm where aircraft altitude is lowest. Calculations were made using the program SEL_CALC under median atmospheric noise propagation conditions at JBER (59° F and 71% R.H.). Variable weather conditions (e.g., wind direction, wind intensity, temperature profile, relative humidity) have a limited affect on received aircraft noise levels. For example, monthly average atmospheric sound absorption coefficients at JBER vary from median value by less than 1.3 dB per 1,000 feet. The term 'A-weighted' denotes adjustment of component frequency band sound pressure levels to reflect human hearing. Decibels are a way of expressing sound levels that involves the ratio of a sound pressure against a reference pressure level. By convention, sound levels in air are stated as referenced to 20 μ Pa.

Step 2: Calculate Maximum *in-water* noise level associated with overflights. The A-weighted noise levels re 20 μ Pa reported by SEL_CALC were converted to estimated un-weighted sound pressure levels (SPL) re 1 μ Pa. A-weighted and un-weighted F-22 aircraft noise levels from the NOISEMAP NOISEFILE database were compared for several F-22 aircraft configurations, and it was found that un-weighted noise levels were consistently 2.9 to 3.1 dB higher than A-weighted noise levels. Three dB were added to A-weighted noise levels to

estimated un-weighted SPL. It should be noted that odontocete hearing is not strong at low frequencies (Southall *et al* 2007). Much of the noise energy generated by jet aircraft is at low frequencies, and use of un-weighted SPL yields conservative estimates of noise impacts to belugas. Transmission of sound from a moving airborne source to a receptor underwater is influenced by numerous factors and has been studied extensively (Richardson *et al.* 1995, Young 1973, Urlick 1972). In this wildlife analysis, twenty-six dB were added to SPL re 20 μ Pa to convert to SPL re 1 μ Pa and, an additional 6 dB are added to account for doubling of sound pressure as the sound rays cross the interface between air and water. Taking into account sound metric conversion and the reflectance of noise energy at the air-water interface, noise levels in water (SPL re 1 μ Pa) were calculated as being 35 dB higher than noise levels in air just above the water's surface (LA_{max} re 20 μ Pa). Additional discussion on transmission of aircraft noise into water is located in 'Step 4: Establish area exposed to noise exceeding thresholds'.

Step 3: Establish threshold for potential effects. Calculated noise levels generated by F-22 aircraft in the Knik Arm do not exceed 137 dB SPL re 1 μ Pa, well below the threshold for temporary hearing loss (195 dB re 1 μ Pa²-s) and permanent hearing loss (215 dB re 1 μ Pa²-s) for non-pulse sound. However, such noise levels do have some probability of causing a behavioral reaction such as area avoidance or alteration of natural behaviors.

The most appropriate acoustic threshold is currently the odontocete risk function, which assesses the probability of a behavioral reaction from 120 dB SPL to 195 dB SPL for non-pulse sound (U.S. Navy 2008). The risk function was derived by the U.S. Navy and NMFS to determine effects from mid-frequency sonar. However, the odontocete risk function is currently the best available science for predicting behavioral effects from intermittent, non-impulsive (non-pulse) sound.

The risk function is used to estimate the percentage of an exposed population that is likely to exhibit behaviors at a given received level of sound (NOAA 2009, NMFS 2009). For example, at 165 dB SPL (dB re: 1 μ Pa rms), the risk (or probability) of harassment is 50 percent, and NMFS applies that 50 percent of the individuals exposed at that received level are likely to respond by exhibiting behavior that NMFS would classify as behavioral harassment (NOAA 2009, NMFS 2009).

The values used in the odontocete risk function are based on three sources of data: Temporary threshold shift (TTS) experiments conducted at Space and Warfare Systems Center (SSC) and documented in Finneran, et al. (2001, 2003, and 2005; Finneran and Schlundt 2004); reconstruction of sound fields produced by the USS SHOUF associated with the behavioral responses of killer whales observed in Haro Strait and documented in NMFS (2005), DoN (2004), and Fromm (2004a, 2004b); and observations of the behavioral response of North Atlantic right whales exposed to alert stimuli containing mid-frequency components documented in Nowacek et al. (2004).

The risk function represents a general relationship between acoustic exposures and behavioral responses. The risk function, as currently derived, treats the received level as the only variable that is relevant to a marine mammal's behavioral response. However, we know that many other variables—the marine mammal's gender, age, and prior experience; the activity it is engaged in during an exposure event, its distance from a sound source, the number of sound sources, and whether the sound sources are approaching or moving away from the animal—can be critically

important in determining whether and how a marine mammal will respond to a sound source (Southall et al. 2007). The data that are currently available do not allow for incorporation of these other variables in the current risk functions; however, the risk function represents the best use of the data that are available (NOAA 2009).

The odontocete risk function curve was adapted from Feller 1968 (Figure 3)

$$R = \frac{1 - \left(\frac{L - B}{K} \right)^{-A}}{1 - \left(\frac{L - B}{K} \right)^{-2A}}$$

Where: R = risk (0 - 1.0);

L = Received Level (RL) in dB;

B = Basement RL (i.e. lowest RL at which behavioral reaction possible) in dB;

K = the RL increment above basement in dB at which there is 50 percent risk;

A = Risk transition sharpness parameter

Feller function parameter values used in this analysis were selected in keeping with values used to predict behavioral reaction from non-impulsive noise to odontocetes in the U.S. Navy Atlantic Fleet Active Sonar Training (AFAST) Environmental Impact Statement (EIS) (U.S. Navy 2008). The values published in the AFAST EIS (A=10, K=45 dB SPL, and B = 120 dB SPL) were selected based on extensive research and coordination with NMFS.

Establishment of a risk modeling basement threshold (e.g. lowest noise level at which impacts could potentially occur) of 130 dB re 1 µPa was considered and eventually rejected. Average measured ambient noise levels in the portion of the Knik Arm due west of the JBER runway have been reported as being 119 dB re 1 µPa and 125 dB re 1 µPa (Blackwell and Greene 2002, KABATA *et al.* 2010). Sounds that are louder than ambient noise levels by less than the “critical ratio” and that are in the same frequency band as ambient noise sources, would not typically be perceived by the animal as a distinct noise source, and would not be expected to generate any direct behavioral reaction (Richardson *et al.* 1995). Odontocete critical ratios are typically between 10 and 20 dB at the lower frequencies concerned here, with the actual value varying by frequency and species (Richardson *et al.* 1995). Figure 1 shows F-22 noise energy in frequency bands between 10 and 10,000 Hz in several aircraft configurations, as taken from the NOISEFILE database. Jet noise is most intense in low frequency bands (e.g., <4000 Hz). Although jet noise does occur in frequency bands greater than 10 kHz it is of relatively low intensity and is not included in the NOISEFILE database. Ambient noise sources in the Knik Arm also have a majority of their noise energy at similarly low frequencies (Blackwell and Greene 2002). Therefore, aircraft overflight noise events less than 130 dB re 1 µPa (120 dB re 1 µPa ambient noise level plus 10 dB critical ratio) would be expected to be heard only indistinctly by belugas and would not be expected to generate any behavioral reaction. However, although unlikely, it is possible that belugas could perceive F-22 noise at levels below 130 dB re 1 µPa and have a behavioral reaction to the sound. To ensure conservative analysis

results (i.e. over-estimation of potential effects), 120 dB re 1 μ Pa was adopted as the basement threshold for impacts.

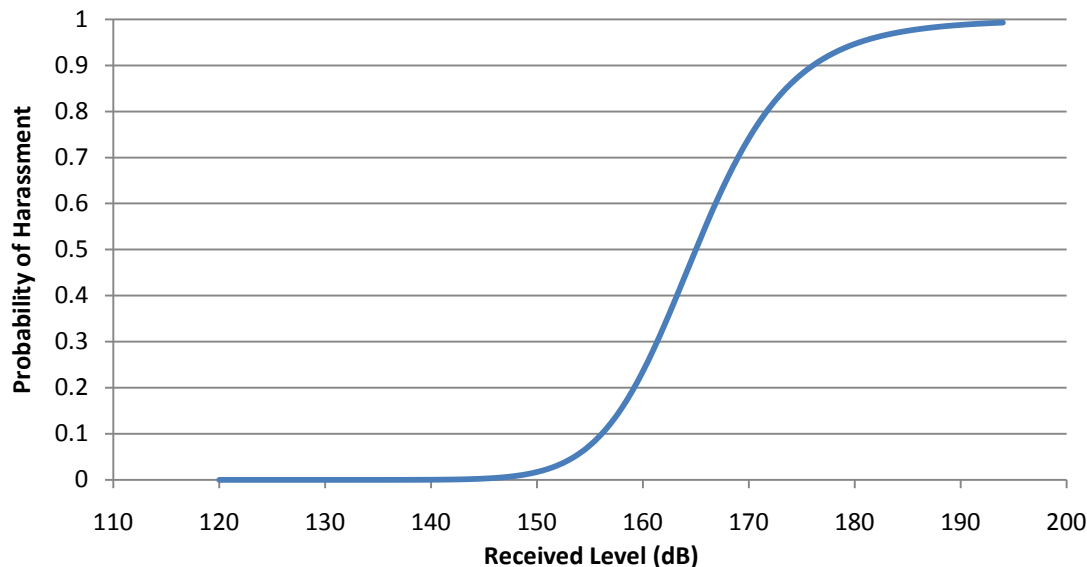


Figure 1. Risk Function Curve for Odontocetes

Source: U.S. Navy 2008

Step 4: Establish area exposed to noise exceeding thresholds. For each F-22 event type for which SPL exceeds 120 dB re 1 μ Pa at the loudest point, SEL_CALC was used to calculate the slant range at which noise level drops below 120, 125, and 130 dB re 1 μ Pa. Along each representative aircraft flight track, the aircraft altitude at several increments was calculated based on data reported by F-22 pilots. At each distance increment, the lateral distance from the flight track at which the critical slant range would be exceeded was calculated (see Figure 2). At a certain distance from the airfield, aircraft altitude is high enough that noise levels at the water's surface would not exceed 120 dB SPL re 1 μ Pa even directly beneath the flight track. Flight tracks and lateral distance to threshold noise level were plotted using ESRI Geographic Information System software and compared to shoreline to allow calculation of water area affected at 120-125 dB re 1 μ Pa, 125-130 dB re 1 μ Pa, and greater than 130 dB re 1 μ Pa.

According to Snell's Law, noise energy that intersects the water's surface at more than 13 degrees from vertical is almost entirely reflected. The area of maximum transmission can therefore be visualized as a 13-degree cone (26 degree aperture) with the aircraft at its apex. Outside of this area, only the upper few meters of the water column would typically be affected by elevated noise levels during an overflight. Because sound waves would have decreased to below threshold noise levels prior to reaching the bottom at any but the shallowest water depths, reflected sound energy from the bottom was not considered as part of this study.

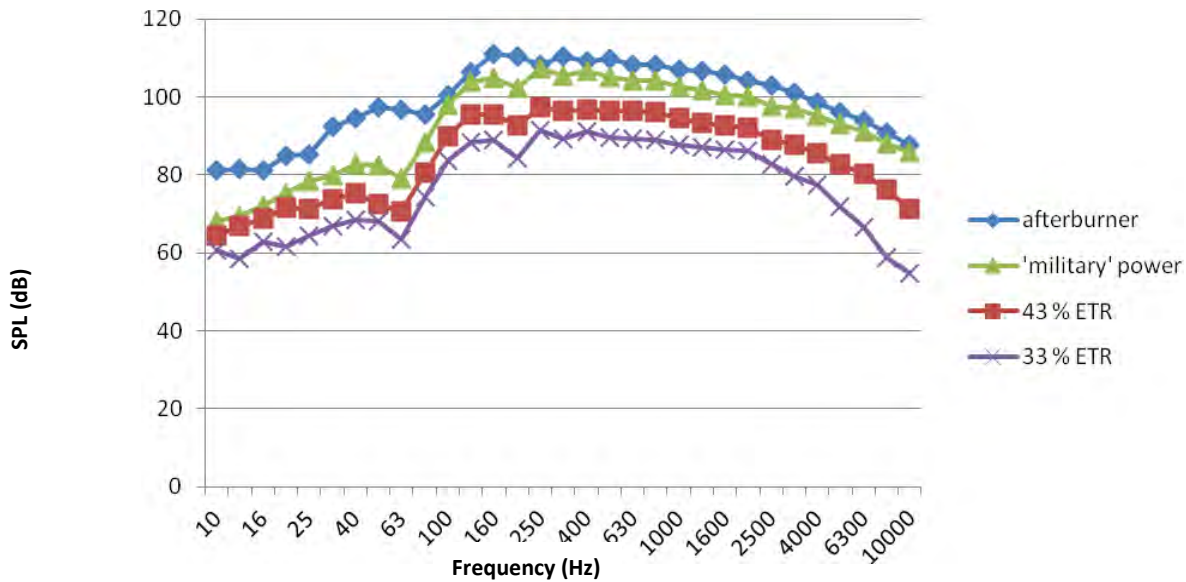


Figure 2. Un-weighted SPL re 20 μ Pa (In-Air) at 10-10,000 Hz Generated by F-22 Overflight at 1,000 AGL in Several Aircraft Configurations

When the sea surface is rough, a common condition in the Knik Arm, reflectance of noise energy is highly variable, depending on the angle at which incoming sound waves impact individual wave surfaces. In general, when the wave face is close to perpendicular to inbound sound rays, more energy enters the water. When sound rays happen to impact a wave face that is oblique to the direction of the ray, more energy is reflected from the water's surface. This variable transmission can lead to isolated volumes of water being very briefly exposed to higher noise levels than would occur under calm sea conditions. The location and extent of this phenomenon depends heavily on specific sea conditions. For simplicity, this analysis assumed equal transmission of sound waves across the air-water interface for anywhere the basement threshold of 120dB re 1 μ Pa is exceeded at the water's surface. Snell's law dictates sound waves are only directly transmitted into the water at 13 degrees or less from the vertical. By ignoring Snell's law in the model, different sea states causing sound to enter the water in multiple transmission paths and evanescent surface scattering can be conservatively accounted for by calculating the largest possible footprint. It is also assumed for the analysis that the footprint extends from the surface to the bottom, even for areas outside of the 13-degree cone (26-degree aperture) dictated by Snell's law that would limit sound energy to the first few meters of the water column. Animals at depth would also experience lower sound levels than at the surface due to transmission loss in the water column.

Step 5: Determine the density of Cook Inlet beluga whales in Knik Arm. Surveys conducted as part of the Knik Arm Crossing Project, indicate that average beluga density during the month of September was 0.08 individuals per square kilometer (KABATA *et al.* 2010). September was the month during which the highest density of belugas was observed. However, to ensure conservative analysis results, a larger density value was used. The larger density value was based on the current (2010) estimated CIBW population of 340 individuals (NMFS 2010) divided by 2,800 km², the area estimated to represent 95 percent of the occupied CIBW range (Rugh *et al.* 2010), thus yielding a density estimate of 0.12 beluga whales/km².

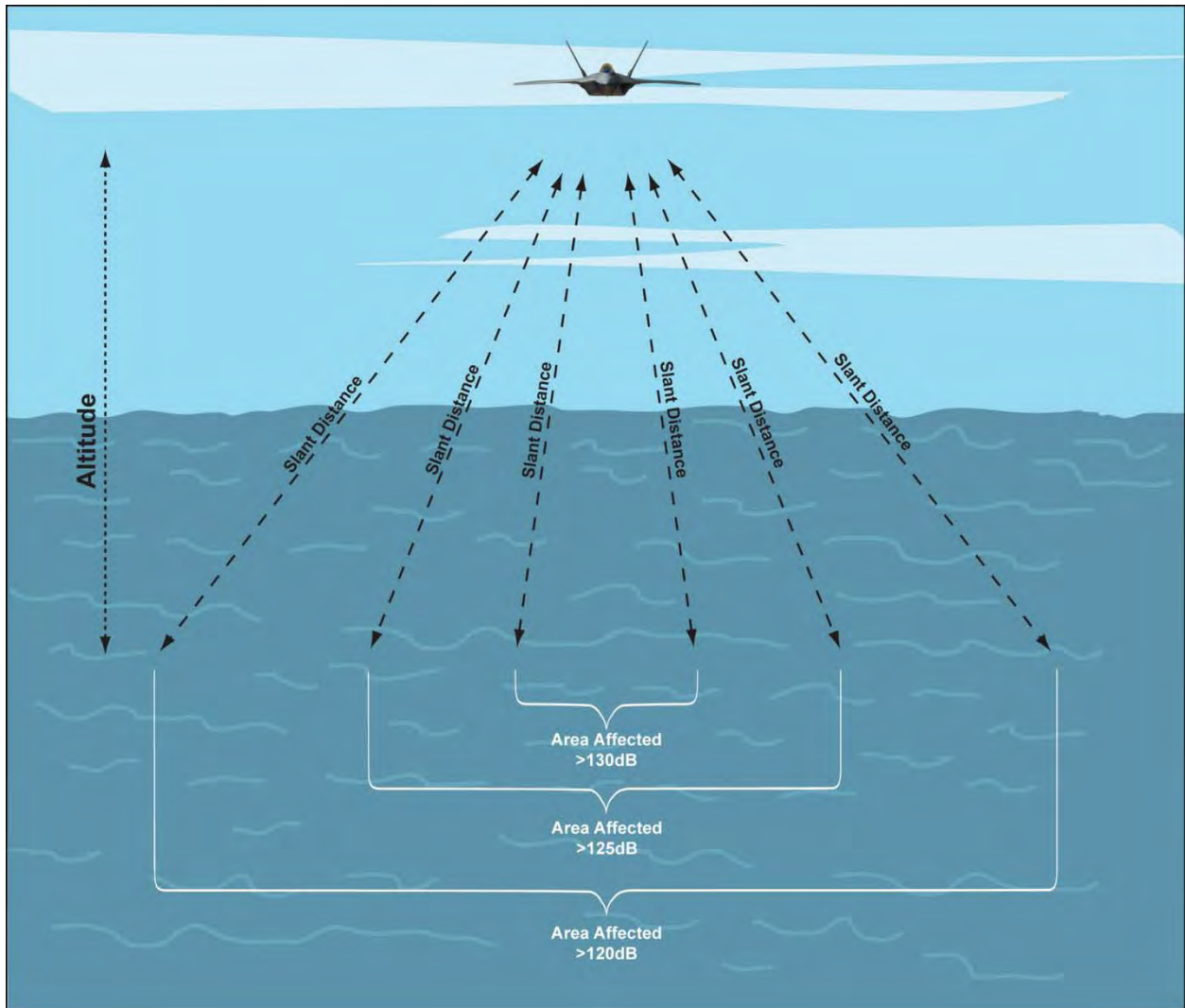


Figure 3. Calculation of Lateral Distance From Aircraft Flight Track At Which Surface Water Ensonified at >120, >125, and >130 dB SPL

Step 6: Calculate potential behavioral reactions. The number of times per average busy flying day (i.e., non-holiday weekday with reasonably good weather) that the proposed additional F-22 aircraft would conduct each event type was multiplied by the total number of average busy flying days per year.

The footprint bins (120-125dB; 125-130dB; and 130-137dB re 1 μ Pa) for each type of event (calculated above in step 4) were multiplied by the annual number of events to calculate total annual footprints per type of overflight. The number of animals exposed to levels in each footprint bin were then calculated by multiplying the highest Cook Inlet beluga whale density derived in any given month (see step 5 above) by the area of each of the annual footprints. Then, within each footprint bin, the number of animals that would likely exhibit a behavioral response was predicted by multiplying the number of animals exposed annually, by the probability of behavioral response at the highest sound level within that footprint bin according to the odontocete risk function (see step 3 above for an explanation of the odontocete risk function). To yield conservative impact estimates, the entire noise footprint area (i.e., 120-125 dB

re 1 μ Pa, 125-130 dB re 1 μ Pa, and greater than 130 dB re 1 μ Pa) was treated as if it were affected by the highest noise level in that range. The probability corresponding to 125dB re 1 μ Pa was used for the 120-125 dB re 1 μ Pa footprint; 130dB re 1 μ Pa for 125-130 dB re 1 μ Pa; and 137dB re 1 μ Pa for the 130-137 dB re 1 μ Pa footprint. For each overflight type, the predicted behavioral reactions in each footprint bin are added to yield the predicted annual behavioral responses for that type of overflight. The number of animals predicted to exhibit a behavioral response annually for each type of event is then added together to yield the annual total number of predicted behavioral responses for all proposed F-22 overflight events.

1.17 Results

Based on application of the methodology described above, approximately 0.04 belugas would be behaviorally harassed annually resulting from proposed additional F-22 flying operations (Table 1).

Table 1. Estimated Annual Beluga Behavioral Responses Resulting From Proposed Additional F-22 Flying Operations

	<i>Aircraft Configuration</i>		<i>Noise Levels</i>		<i>Events Per Year</i>	<i>Number of Belugas in Affected Area</i>				<i>Risk of Behavioral Responses</i>			
	Lowest Altitude Over Water (MSL)	Power (% ETR)	LA _{max} Just Above Surface (dB re 20 µPa)	SPL Just Below Surface (dB re 1 µPa)	Additional Events Per Year (Proposed Action)	Area Affected at 120-125 dB SPL (sq km)	Area Affected at 125-130 dB SPL (sq km)	Area Affected at >130 dB SPL (sq km)	Approx. Beluga Density (Animals per km ²)	Prob. of Behavioral Response at Highest Level Within 120-125 dB SPL	Prob. of Behavioral Response At Highest Level Within 125-130 dB SPL	Response at Highest Level >130 dB SPL (0 if max SPL <130)	Avg. # Additional Beluga Behavioral Responses Per Year (Proposed F-22 Ops)
EEEGL 2 Departure on RW 24 (military and A/B power departures identical at overwater segment)	2527	90	100.3	135.3	535	38.82	15.59	4.09	0.12	2.9E-10	2.9E-07	3.2E-05	8.8E-03
EEEGL 2 Departure on RW 34	4295	90	93.5	128.5	703	26.63	5.63	0.00	0.12	2.9E-10	1.0E-07	0.0E+00	4.9E-05
IFR Approach (IFR arrival and IFR closed pattern are identical in overwater segment)	653	33	101.7	136.7	519	29.83	15.67	6.95	0.12	2.9E-10	2.9E-07	5.9E-05	2.6E-02
MATSU Transition (initial approach)	3500	33	82.3	117.3	593	0.00	0.00	0.00	0.12	0.0E+00	0.0E+00	0.0E+00	0.0E+00
RAPTR Transition (initial approach)	3706	43	88.1	123.1	446	5.05	0.00	0.00	0.12	1.7E-12	3.1E-11	0.0E+00	4.7E-10
ALL VFR approaches (overhead break) AND visual closed patterns	709	33	100.9	135.9	934	5.58	3.21	1.13	0.12	2.9E-10	2.9E-07	3.2E-05	4.2E-03
Re-entry Pattern (initial approach)	1700	33	91.3	126.3	24	13.84	5.47	0.00	0.12	2.9E-10	3.2E-08	0.0E+00	5.0E-07
TOTAL	0.04												

1.18 Appendix 1 References

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APPENDIX 2. INFORMATION ON BELUGA WHALE HEARING AND VOCALIZATIONS*

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Beluga whale (*Delphinapterus leucas*) in-water vocalizations include whistles, squeals, bleats, yelps, bangs, chirps, trills, hums, peeps, yelps, blares, rasps, squawks, bangs, and growls, and clicks and creaks associated with echolocation (Fish and Mowbray, 1962; Anderson, 1974; Ford, 1975; Sjare, 1986; Thompson and Richardson, 1995). Beluga whales have also been reported to produce high pitched screams and a variety of squeaks and squeals above the water surface (Ford, 1975). Ford (1975) reported frequencies for beluga whale in-water social vocalizations to range 0.80–29 kHz with out-of-water vocalizations that ranged 0.95–20 kHz. Flat contour, upsweep, and variable contour sounds were recorded from a beluga whale calf that ranged in frequency from 400 Hz to 15.1 kHz (Parijs *et al.*, 2003). Belikov and Bel'kovich (2007) identified 16 whistle types of beluga whales that had average values of maximum fundamental frequency between 1.4–4.5 kHz. Beluga whale echolocation vocalization frequencies have been reported to range 1.0–120 kHz (Ford, 1975, Au *et al.*, 1985).

Measuring short-latent auditory evoked potentials (SAEP) of two male beluga whales with their heads above the water's surface, Popov and Supin (1987) reported their range of hearing to be limited to 110 kHz with a maximum sensitivity at 60–70 kHz. Using evoked potential methods, Klishin *et al.* (2000) also tested a captive beluga whale in a pool with its head out-of-water and reported a broader range of maximum sensitivities (32–108 kHz).

Results from behavioral tests conducted underwater in a concrete pool for two beluga whales indicated upper frequency limits around 122 kHz with maximum sensitivity around 30 kHz (White *et al.*, 1978). Awbrey *et al.* (1988) measured the hearing sensitivity of a captive adult male, adult female and juvenile male beluga whale tested in a concrete pool using underwater behavioral techniques at test frequencies between 125 Hz and 8 kHz and reported an average threshold of 65 dB re 1 μ Pa at 8 kHz. The juvenile male was slightly more sensitive to low frequencies than either of the adults. Ridgway *et al.* (2001) reported behavioral hearing thresholds for two beluga whales at depths of 5, 100, 200 and 300 m in the open ocean at frequencies between 0.5 kHz to 100 kHz with maximum sensitivities between 8 and 24 kHz. In underwater behavioral tests conducted in San Diego Bay closer to the surface (i.e., 1.5 m), Finneran *et al.* (2002) reported that two captive beluga whales were able to detect 0.4 kHz tones at 117 \pm 1.6 dB re 1 μ Pa. Finneran *et al.* (2005) obtained underwater hearing thresholds for two other beluga whales housed and tested behaviorally in an indoor facility. Test frequencies that ranged 2.0–130 kHz. Best sensitivities for one subject ranged from approximately 40 to 50 dB re 1 μ Pa at 50–80 kHz with functional hearing above 100 kHz. The second subject had best sensitivity that ranged 40 to 50 dB re 1 μ Pa at 30–35 kHz and an upper frequency cutoff of about 50 kHz. The high-frequency hearing loss in the latter subject was attributed to the treatment with the aminoglycoside antibiotic amikacin which is toxic to hair cells in the cochlea of the ear.

Schlundt *et al.* (2000) reported temporary threshold shifts in the masked hearing thresholds (MTTS) of two beluga whales exposed to 1-s pure tones at 0.4, 3, 10, and 20 kHz. One of the subjects experienced a 12-dB MTTS in response to a 3-kHz tone of 195 dB re 1 μ Pa. The other

subject experienced a 7-dB MTTs after exposure to a 10-kHz tone of 192 dB re 1 μ Pa. Both subjects had MTTs of 6–12 dB following 20-kHz tones at levels between 197 to 201 dB re 1 μ Pa. Neither subject experienced an MTTs after exposure to 0.4 kHz tones up to 193 dB re 1 μ Pa. Deviations in the whales' trained behaviors were observed following exposures that ranged from 180–196 dB re 1 μ Pa at all four exposure frequencies.

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DEPARTMENT OF THE AIR FORCE
HEADQUARTERS, 673D AIR BASE WING
JOINT BASE ELMENDORF-RICHARDSON, ALASKA

11 Feb 11

MEMORANDUM FOR NOAA Fisheries' National Marine Fisheries Service
Protected Resources Division and Habitat Conservation Divisions
Attn: Ms. Kate Savage

FROM: 673 CES/CC
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson AK 99506-3240

SUBJECT: Wildlife Analysis for F-22 Supplemental Environmental Assessment

1. The United States Air Force (Air Force) is preparing an F-22 Plus-Up Environmental Assessment (EA) to evaluate the potential environmental consequences of the proposal to add six primary and one back-up F-22 aircraft to the Joint Base Elmendorf-Richardson (JBER) F-22 inventory, an increase in primary aircraft of approximately 17 percent. The purpose of the proposed plus-up is to provide additional Air Force capabilities at a strategic location to meet mission responsibilities for worldwide deployment. Additional F-22 aircraft are needed at JBER to provide U.S. Air Force capability to respond efficiently to national objectives, be available for contingencies, and enhance F-22 operational flexibility.
2. Pursuant to analysis of the proposed additional aircraft and to support compliance with the Endangered Species Act, we initiated an informal consultation in Oct 2010 and received information regarding federally listed threatened, endangered, candidate, and proposed to be listed species that occur or may occur in the potentially affected area from your office on 1 Nov 2010. Having reviewed the provided information, we are pleased to submit the attached Section 7 (Endangered Species Act) Compliance Wildlife Analysis for F-22 Plus-Up Environmental Assessment, Joint Base Elmendorf-Richardson (JBER) Alaska. A determination of "may affect not likely to adversely affect" is found for all species analyzed. We request your concurrence with the "the may affect not likely to adversely affect" determination with regard to species covered by your agency.
3. If you have any specific questions about the wildlife analysis or the proposal, please contact us. The primary point of contact is Ms. Ellen Godden, (907) 552-7483 and an alternate point of contact is Ms. Valerie Payne, (907) 552-3376. Thank you for your assistance in this matter.

J. DAVID NORTON, Lt Col USAF
Commander

Attachment:
Wildlife Analysis



UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration

National Marine Fisheries Service

P.O. Box 21668

Juneau, Alaska 99802-1668

February 22, 2011

Ms. Ellen Godden
673 CES/CEAOP
6326 Arctic Warrior Drive
Joint Base Elmendorf-Richardson, AK 99506-3240

Dear Ms. Godden:

The National Marine Fisheries Service (NMFS) has reviewed the "Section 7 (Endangered Species Act) Compliance Wildlife Analysis for F-22 Plus-Up Environmental Assessment" (EA), dated February 11, 2011. In your letter to NMFS, you requested concurrence that the proposed action "may affect, but is not likely to adversely affect", federally listed threatened, endangered or proposed species under NMFS' jurisdiction, including the Cook Inlet Beluga Whale and Western Distinct Population Segment (DPS) of Steller Sea Lion. An agency action is considered not likely to adversely affect listed species or designated critical habitat when its effects are expected to be completely beneficial, discountable, or insignificant. Beneficial effects are synchronous positive effects without any adverse effects to the species or critical habitat. Discountable effects are those extremely unlikely to occur. Insignificant effects relate to the size of the impact and may not reach the scale where take occurs. Based on best judgment, a person would not expect discountable effects to occur; or be able to meaningfully measure, detect or evaluate insignificant effects. The EA also considered project impacts on the five Primary Constituent Elements (PCE) of the proposed Cook Inlet beluga whale critical habitat (74 FR 63095, December 2, 2009) with the determination that the project would not result in adverse modification of the proposed critical habitat.

Summary of EA

The action concerns the addition of six primary and one backup F-22 aircraft to the existing fleet of 36 primary and three backup F-22 aircraft located at Joint Base Elmendorf-Richardson (JBER), Alaska. The increase of the six operational aircraft would increase the number of F-22 sorties by approximately 21 percent. The action area encompasses portions of the Knik Arm that are overflowed by F-22 aircraft on established approach, departure and reentry patterns to the west and north of JBER runways. Two ESA listed species were included in the assessment, the Cook Inlet beluga whale and Steller sea lion.

Regarding Cook Inlet beluga whales (*Delphinapterus leucus*), both individuals and groups are seasonally common in Knik Arm adjacent to JBER. Whales have been noted milling, foraging and socializing in river mouths near Six Mile Creek, North Eagle Bay, Eagle River and Point McKenzie, primarily coincident with the coho salmon run. The



greatest number of whales in Knik Arm has generally been observed between August and November, with the whales tending to move north into Knik Arm with the flooding tide, usually within one mile of the eastern shore, and move south out of Knik Arm on the ebbing tide, usually within one mile of the western shore. In or adjacent to JBER, whales have been observed in Eagle Bay and also occasionally feeding at the mouth of Six Mile Creek. Although up to 71 whales have been seen in Eagle Bay during a single summer observation, the average daily visits to the area included nine whales.

The EA then assessed impacts of the action on the Cook Inlet beluga whale, which include acoustic and visual disturbance. Because acoustic disturbance is the predominant impact of the action, the sound profile of the additional F-22's was evaluated in relation to the five major categories of acoustic effect, including 1. Direct trauma; 2. Auditory fatigue; 3. Auditory masking; 4. Stress response; and 5. Behavioral reactions. Neither direct trauma nor auditory fatigue was a predicted outcome of the action based on the level and duration of the modeled F-22 sound profile. The maximum sound pressure level of an F-22 overflight within water was calculated at 137 dB re 1 μ Pa for a duration of a few seconds, which was not considered sufficiently intense or long-lasting to result in direct trauma or auditory fatigue. Auditory masking was not expected because the F-22 overflight noise levels are close enough to ambient noise, which normally exceeds 120 dB re 1 μ Pa in the area, and are of very short duration. Regarding stress response and behavioral reactions, an analytical model was used to quantify potential behavioral disturbances based on predicted sound levels, animal threshold reactions to similar sounds and Cook Inlet beluga whale density. Based upon the results of all flight profiles, the number of behavioral reactions was conservatively estimated at less than 0.04 individuals per year. Additional factors for consideration included the possibility of habituation, the sound frequency of jet engines being predominantly lower than the best hearing range of belugas, the very brief duration of exposure and high ambient noise levels in the area. The likelihood of behavioral reaction was summarized as discountable. Potential visual impacts were considered minimal because of the flight altitude (weighted average of closest approach to water was 2,250 feet MSL for all flight paths), small size of the aircraft and rapidity of flight. Based on the acoustic and visual impact assessments, it was concluded that the project may affect, but is not likely to adversely affect the Cook Inlet beluga whale.

Project effects were also analyzed relative to the five Primary Constituent Elements of the proposed Cook Inlet beluga whale critical habitat. No effects were expected on water quality or hydrology, prey species or beluga whale passage within or between critical habitat, no introduction of toxins or harmful substances was expected and in water noise levels were not expected to result in the abandonment of habitat. It was concluded that the project would not result in adverse modification of the proposed critical habitat of the Cook Inlet beluga whale.

Regarding Steller sea lions (*Eumetopias jubatus*), the presence of the species is considered very rare in Knik Arm and the EA included the sighting of a single animal in 2009. With respect to potential impacts on Steller sea lions, the EA determined that, because the species does not normally occur in the action area, the combined likelihood

of an occurrence and elevated F-22 noise event is discountable. Therefore, the action may affect, but is not likely to adversely affect the Western DPS of Steller sea lion.

Discussion

A. Cook Inlet Beluga Whale

The Cook Inlet beluga stock has probably always numbered fewer than several thousand animals, but has declined significantly from its historical abundance. In 1979, the Cook Inlet beluga stock was estimated at 1300 animals (Calkins 1989), which subsequently decreased to 653 animals in 1994 and to an estimated 340 in 2010 (NMFS 2010).

Beluga whales use sound rather than sight for many important functions, including communication, prey location and navigation. In Cook Inlet, beluga whales must compete acoustically with natural and anthropogenic sounds. Man-made sources of noise in Cook Inlet include large and small vessels, aircraft, oil and gas drilling, marine seismic surveys, pile driving, and dredging. The effects of man-made noise on beluga whales depend on several factors including the intensity, frequency and duration of the noise, the location and behavior of the whale, and the acoustic nature of the environment. High frequency noise diminishes more rapidly than lower frequency noises. Sound also dissipates more rapidly in shallow waters and over soft bottoms (sand and mud). Much of upper Cook Inlet is characterized by its shallow depth, sand/mud bottoms, and high background noise from currents and glacial silt (Blackwell and Greene 2002) thereby making it a poor acoustic environment.

Anthropogenic noise above ambient levels and within the same frequencies used by belugas may mask communication between these animals. At louder levels, noise may result in disturbance and harassment, or cause temporary or permanent damage to the whales' hearing. Although captive beluga whales have provided some insight into beluga hearing and the levels of noise that might damage their hearing capabilities, much less information is available on how noise might impact beluga whales behaviorally in the wild. In the Canadian high Arctic, beluga whales were observed to react to ice-breaking ships at distances of more than 80 km, showing strong avoidance, apparent alarm calls, and displacement (Finley et al. 1990). However, in less pristine, more heavily trafficked areas belugas may habituate to vessel noise.

Beluga whales have a well-developed sense of hearing and echolocation. These whales hear over a large range of frequencies, from about 40-75 Hertz (Hz) to 30-100 kiloHertz (kHz) (Richardson 1995), although their hearing is most acute at relatively high frequencies, between 10 and 100 kHz (Blackwell and Greene 2002), which is generally above the level of much industrial noise. The beluga whales' hearing falls off rapidly above 100 kHz. However, beluga whales may hear sounds as low as 40-75 Hz, although this noise would have to be very loud. Jet aircraft noise is most intense in relatively low frequency bands, primarily below 4 kHz.

Cook Inlet experiences significant levels of aircraft traffic. The Anchorage International Airport is directly adjacent to lower Knik Arm and has high volumes of commercial and

cargo air traffic. Lake Hood and Spenard Lake in Anchorage are also heavily used by recreational seaplanes. Even though sound is attenuated by water surface, Blackwell and Green (2002) found that aircraft noise can be quite loud underwater when jet aircraft are directly overhead. Belugas may be less sensitive to aircraft noise than vessel noise, but individual responses may be highly variable and depend on the beluga's previous experiences, its activity at the time of the noise, and the characteristics of the noise. The area around lower Knik Arm, including the Port of Anchorage, is typically characterized by high levels of ambient noise. The EA cites levels as high as 143 re 1 μ Pa on shipping days for the Port of Anchorage and background levels rarely below 125 dB re 1 μ Pa. NMFS considers the Level A in-water harassment threshold to be 180 dB re 1 μ Pa for cetaceans. Level B harassment from pulsed noise is 160 dB re 1 μ Pa and 125 dB re 1 μ Pa from non-pulsed noise. Of the seven flight paths assessed, sound pressure levels (SPL) ranged from 117.3 to 137 dB re 1 μ Pa. The number of additional events at the maximum SPL was approximately 1.5 per day. Given the high ambient noise in the area, the low number of additional daily events which would be complete in a matter of seconds and the low probability of animals within the path of maximum SPL, the likelihood of behavioral change due to the additional F-22s is insignificant.

Beluga whales may also respond to visual disturbance. In the Beaufort Sea, belugas were observed diving or swimming away when low-flying (<500 m) aircraft passed directly over them (Richardson 1995). However, in Cook Inlet little or no change was noted in beluga swim direction with small aircraft flying at approximately 800 ft, which was considered most likely due to beluga habituation to routine, small aircraft overflights (Rugh et al. 2000). As the weighted closest approach of all F-22 flight paths is 2,250 feet, the likelihood of visual disturbance from the F-22 aircraft is insignificant.

With the exception of the in-water acoustic impacts as addressed above, the action does not include marine components and will, therefore, not affect the PCEs for proposed critical habitat. NMFS agrees that the project will not result in adverse modification of proposed critical habitat of the Cook Inlet beluga whale.

In summary, NMFS concurs with the determination that the proposed action may affect, but is not likely to adversely affect, the population of Cook Inlet beluga whales as well as the determination that the action will not cause adverse modification to proposed critical habitat.

B. Steller sea lions

The Western DPS of Steller sea lion inhabit much of Alaskan coastal waters west of 144°. Within this area, sea lions may traverse and forage over great distances, moving onto terrestrial haulout sites for rest, molting and predator avoidance and seasonal rookery sites for reproductive activities. Critical habitat for Steller sea lions has been designated based on the spatial extent of foraging, prey location and on the location of terrestrial haulout and rookery sites (NMFS 2008). Upper Cook Inlet, including Knik Arm, does not support any Steller sea lion rookeries, haulouts or critical habitat. The species is rarely found there, with the Forelands generally considered the most northerly limit of Steller sea lion range in Cook Inlet (M. Migura, personal communication, NMFS). NMFS agrees

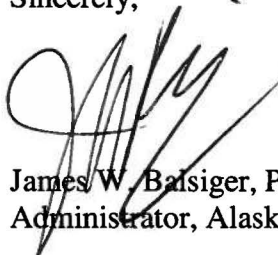
that the combined likelihood of Steller sea lion presence in the action area and F-22 overflight exposure is discountable and that the action may affect, but is not likely to adversely affect, the western DPS of Steller sea lion.

Conclusion

NMFS concurs with your agency's determination that the planned action may affect, but is not likely to adversely affect, ESA-listed species or designated critical habitat under NMFS jurisdiction, including Cook Inlet beluga whale and the western population of Steller sea lion. NMFS also concurs that the action will not result in adverse modification of proposed critical habitat for the Cook Inlet beluga whale.

Re-initiation of consultation is required where discretionary Federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) take of a listed species occurs, (2) new information reveals effects of the action that may affect listed species or critical habitat in a manner or to an extent not considered, (3) the action is subsequently modified in a manner that causes an effect to the listed species or critical habitat not considered, or (4) a new species is listed or critical habitat designated that may be affected by the action. Should any questions or concerns arise, please contact Kate Savage at *Kate.Savage@noaa.gov*.

Sincerely,

A handwritten signature in black ink, appearing to read 'JBalsiger', is written over the typed name and title.

James W. Balsiger, Ph.D.
Administrator, Alaska Region

Cc: Brad Smith

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Appendix F

Review of Effects of Aircraft Noise, Chaff, and Flares on Biological Resources

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APPENDIX F REVIEW OF EFFECTS OF AIRCRAFT NOISE, CHAFF, AND FLARES ON BIOLOGICAL RESOURCES

F1 Introduction

This biological resources appendix addresses the effects of aircraft noise, including sonic booms, on wildlife and domestic animals. This appendix also considers the effects of training chaff and flares on biological resources under the training airspaces used by the Joint Base Elmendorf-Richardson (JBER) F-22s and the transient F-15Cs.

F2 Aircraft Noise

The review of the noise effects literature shows that the most documented reaction of animals newly or infrequently exposed to low-altitude aircraft and sonic booms is the “startle effect.” Although an observer’s interpretation of the startle effect is behavioral (e.g., the animal runs in response to the sound or flinches and remains in place), it does have a physiological basis. The startle effect is a reflex; it is an autonomic reaction to loud, sudden noise (Westman and Walters 1981, Harrington and Veitch 1991). Increased heart rate and muscle flexion are the typical physiological responses.

The literature indicates that the type of noise that can stimulate the startle reflex is highly variable among animal species (Manci *et al.* 1988). In general, studies have indicated that close, loud, and sudden noises that are combined with a visual stimulus produce the most intense reactions. Rotary wing aircraft (helicopters) generally induce the startle effect more frequently than fixed wing aircraft (Gladwin *et al.* 1988, Ward *et al.* 1999). Similarly the “crack-crack” of a nearby sonic boom has a higher potential to startle an animal compared to the thunder-like sound from a distant sonic boom. External physical variables, such as landscape structure and wind, can also lessen the animal’s perception of and response to aircraft noise (Ward *et al.* 1999).

Animals can habituate to fixed wing aircraft noise as demonstrated under controlled conditions (e.g., Conomy *et al.* 1998, Krausman *et al.* 1998) and by observations reported by biologists working in parks and wildlife refuges (Gladwin *et al.* 1988). Brown *et al.* (1999) defined habituation as “... an active learning process that permits individuals to discard a response to a recurring stimulus for which constant response is biologically inappropriate without impairment of their ability to respond to other stimuli.” However, species can differ in their ability to habituate to aircraft noise, particularly the sporadic noise associated with military aircraft training (e.g., Conomy *et al.* 1998). Furthermore, there are no studies that have investigated the potential for adverse effects to wildlife due to long-term exposure to aircraft noise.

F2.1 Ungulates

Wild ungulates appear to vary in sensitivity to aircraft noise. Responses reported in the literature varied from no effect and habituation to panic reactions followed by stampeding (Weisenberger *et al.* 1996; see reviews in Mancini *et al.* 1988). Aircraft noise has the potential to be most detrimental during periods of stress, especially winter, gestation, and calving (DeForge 1981). Krausman *et al.* (1998) studied the response of wild bighorn sheep (*Ovis canadensis*) in a 790-acre enclosure to frequent F-16 overflight at 395 feet AGL. Heart rate increased above preflight level during 7 percent of the overflights but returned to normal within 120 seconds. No behavioral response by the bighorn sheep was observed during the overflights.

Wild ungulates typically have little to no response to sonic booms. Workman *et al.* (1992) studied the physiological and behavioral responses of pronghorn (*Antilocapra americana*), elk (*Cervus elaphus*), and bighorn sheep to sonic booms. All three species exhibited an increase in heart rate lasting from 30 seconds to 1 ½ minutes in response to their first exposure to a sonic boom. After successive sonic booms, this response decreased greatly, indicating habituation.

A recent study in Alaska documented only mild short-term reactions of caribou (*Rangifer tarandus*) to military overflights in the Yukon Military Operations Areas (MOAs) (Lawler *et al.* 2005). A large portion of the Fortymile Caribou Herd calves underneath the Yukon MOAs. The authors concluded that military overflights did not cause any calf deaths, nor did cow-calf pairs exhibit increased movement in response to the overflights. Because daily movements increase with calf age, the authors controlled for calf age in their analysis. Lawler *et al.* (2005) generally only observed higher-level reactions, such as rising quickly from a bedded position or extended running, when the faster F-15 and F-16s were within 1,000 feet above ground level (AGL). They also noted considerable variation in responses due to speed, slant distance, group size and activity, and even individual variation with groups.

In contrast, a study of the Delta Caribou Herd in interior Alaska found that female caribou with calves exposed to low-altitude overflights moved about 2.5 kilometers more per day than those not exposed (Maier *et al.* 1998). The authors, however, stated that this distance was of low energetic cost. Furthermore, this study did not consider calf age in their analyses (Lawler *et al.* 2005), which may bias results. Harrington and Veitch (1991) expressed concern for survival and health of woodland caribou calves in Labrador, where military training flights are allowed within 100 feet AGL.

Few studies of the effects of low-altitude overflights have been conducted on moose (*Alces alces*) or Dall's sheep (*Ovis dalli*). Andersen *et al.* (1996) observed that moose responded more adversely to human stimuli than mechanical stimuli. Beckstead (2004) reported on a study of the effects of military jet overflights on Dall's sheep under the Yukon 1 and 2 MOAs in Alaska. He could find no difference in population trends, productivity, survival rates, behavior, or habitat use between areas mitigated and not mitigated for low-level military aircraft by the Alaska MOAs Environmental Impact Statement (EIS) (United States Air Force [Air Force] 1995). In the mitigated area, flights are restricted to above 5,000 feet AGL during the lambing season, while the unmitigated area could experience flights as low as 100 feet AGL. Similarly, large-force Major Flying Exercises did not adversely affect Dall's sheep.

F2.2 Marine Mammals

The effects of noise on marine mammals, such as dolphins and whales, have been relatively well studied. A detailed analysis of noise properties in water and the potential effects on marine mammals are presented in Append E.

F2.2 Small Mammals

A few researchers have studied the potential affects of aircraft noise on small mammals. Chesser *et al.* (1975) found that house mice (*Mus musculus*) trapped near an airport runway had larger adrenal glands than those trapped 2 kilometers from the airport. In the lab, naïve mice subjected to simulated aircraft noise also developed larger adrenal glands than a control group. However, the implications of enlarged adrenals for small mammals with a relatively short life span are undetermined. The burrows of some small mammals may reduce their exposure to aircraft noise. Francine *et al.* (1995) found that kit foxes (*Vulpes macrotis*) with twisting tunnels leading to deeper burrows experienced less noise than kangaroo rats (*Dipodomys merriami*) with shallow burrows. McClenaghan and Bowles (1995) studied the effects of aircraft overflights on small mammals and were unable to distinguish potential long-term effects due to aircraft noise compared to other environmental factors.

F2.2 Raptors

Most studies have found few negative effects of aircraft noise on raptors. Ellis *et al.* (1991) examined behavioral and reproductive responses of several raptor species to low-level flights. No incidents of reproductive failure were observed and site re-occupancy rates were high (95 percent) the following year. Several researchers found that ground-based activities, such as operating chainsaws or an intruding human, were more disturbing than aircraft (White and Thurow 1985, Grubb and King 1991, Delaney *et al.* 1997). Red-tailed hawks (*Buteo jamaicensis*) and osprey (*Pandion haliaetus*) appeared to readily habituate to regular aircraft overflights (Andersen *et al.* 1989, Trimper *et al.* 1998). Mexican spotted owls (*Strix occidentalis lucida*) did not flush from a nest or perch unless a helicopter was as close as 330 feet (Delaney *et al.* 1997). Nest attendance, time-activity budgets, and provisioning rates of nesting peregrine falcons (*Falco peregrinus*) in Alaska were found not to be significantly affected by jet aircraft overflights (Palmer *et al.* 2003). On the other hand, Andersen *et al.* (1990) observed a shift in home ranges of four raptor species away from new military helicopter activity, which supports other reports that wild species are more sensitive to rotary wing aircraft than fixed-wing aircraft.

The effects of aircraft noise on the bald eagle (*Haliaetus leucocephalus*) have been studied relatively well, compared to most wildlife species. Overall, there have been no reports of reduced reproductive success or physiological risks to bald eagles exposed to aircraft overflights or other types of military noise (Fraser *et al.* 1985, Stalmaster and Kaiser 1997, Brown *et al.* 1999; see review in Buehler 2000). Most researchers have documented that pedestrians and helicopters were more disturbing to bald eagles than fixed-wing aircraft, including military jets (Fraser *et al.* 1985, Grubb and King 1991, Grubb and Bowerman 1997). However, bald eagles can be disturbed by fixed-wing aircraft. Recorded reactions to disturbance ranged from an alert posture to flushing from a nest or perch. Grubb and King (1991) reported that 19 percent of breeding eagles were disturbed when an aircraft was within 625 meters (2,050 feet).

F2.2 Waterfowl and Other Waterbirds

In their review, Mancini *et al.* (1988) noted that aircraft can be particularly disturbing to waterfowl. Conomy *et al.* (1998) suggested, though, that responses were species-specific. They found that black ducks (*Anas rubripes*) were able to habituate to aircraft noise, while wood ducks (*Aix sponsa*) did not. Black ducks exhibited a significant decrease in startle response to actual and simulated jet aircraft noise over a 17-day period, but wood duck response did not decrease uniformly following initial exposure. Some bird species appear to be more sensitive to aircraft noise at different times of the year. Snow geese (*Chen caerulescens*) were more easily disturbed by aircraft prior to fall migration than at the beginning of the nesting season (Belanger and Bedard 1989). On an autumn staging ground in Alaska (i.e., prior to fall migration), 75 percent of brant (*Branta bernicla*) and only 9 percent of Canada geese (*Branta canadensis*) flew in response to aircraft overflights (Ward *et al.* 1999). There tended to be a greater response to aircraft at 1,000 to 2,500 feet AGL than at lower or higher altitudes. In contrast, Kushlan (1979) did not observe any negative effects to wading bird colonies (i.e., rookeries) when fixed-wing aircraft conducted surveys within 200 feet AGL; 90 percent of the observations indicated no reactions from the birds. Nesting California least terns (*Sterna albifrons browni*) did not respond negatively to a nearby missile launch (Henningson, Durham, and Richardson 1981).

Previous research also shows varied responses of waterbirds to sonic booms. Burger (1981) found that herring gulls (*Larus argentatus*) responded intensively to sonic booms and many eggs were broken as adults flushed from nests. One study discussed by Mancini *et al.* (1988) described the reproductive failure of a colony of sooty terns (*Sterna fuscata*) on the Dry Tortugas reportedly due to sonic booms. However, based on laboratory and numerical models, Ting *et al.* (2002) concluded that sonic boom overpressures from military operations of existing aircraft are unlikely to damage avian eggs.

F2.2 Domestic Animals

As with wildlife, the startle reflex is the most commonly documented effect on domestic animals. Results of the startle reflex are typically minor (e.g., increase in heart rate or nervousness) and do not result in injury. Espmark *et al.* (1974) did not observe any adverse effects due to minor behavioral reactions to low-altitude flights with noise levels of 95 to 101 A-weighted decibels (dBA). They noted only minimal reactions of cattle and sheep to sonic booms, such as muscle and tail twitching and walking or running short distances (up to 65 feet). More severe reactions may occur when animals are crowded in small enclosures, where loud, sudden noise may cause a widespread panic reaction (Air Force 1993). Such negative impacts were typically only observed when aircraft were less than 330 feet AGL (United States Forest Service 1992). Several studies have found little direct evidence of decreased milk production, weight loss, or lower reproductive success in response to aircraft noise or sonic booms. For example, Head *et al.* (1993) did not find any reductions in milk yields with aircraft Sound Exposure Levels (SEL) levels of 105 to 112 dBA. Many studies documented that domestic animals habituate to aircraft noise (see reviews in Mancini *et al.* 1998; Head *et al.* 1993).

There is little direct evidence that aircraft noise or sonic booms can cause domestic chicken eggs to crack or result in lower hatching rates. Stadelman (1958) did not observe a decrease in

hatchability when domestic chicken eggs were exposed to loud noises measured at 96 dB inside incubators and 120 dB outside. Bowles and Seddon (1994) found no difference in the hatch rate of four groups of chicken eggs exposed to 1) no sonic booms (control group), 2) sonic booms of 3 pounds per square foot (psf), 3) sonic booms of 20 psf, and 4) sonic booms of 30 psf. No eggs were cracked by the sonic booms and all chicks hatched were normal.

F3 Training Chaff and Flares

Specific issues and potential impacts of training chaff and flares on biological resources are discussed below. These issues have been identified by Department of Defense (DoD) research (Air Force 1997, Cook 2001), General Accounting Office review (United States General Accounting Office 1998), independent review (Spargo 1999), resource agency instruction, and public concern and perception. No reports to date have documented negative impacts of training chaff and flares to biological resources. These studies are reviewed below.

Concerns for biological resources are related to the residual materials of training chaff and flares that fall to the ground or dud flares. Residual materials are several flare components, including plastic end caps, felt spacers, aluminum-coated wrapping material, plastic retaining devices, and plastic pistons. Specific issues are (1) ingestion of chaff fibers or flare residual materials; (2) inhalation of chaff fibers; (3) physical external effects from chaff fibers, such as skin irritation; (4) effects on water quality and forage quality; (5) increased fire potential; and (6) potential for being struck by large flare debris (the plastic Safe and Initiation [S&I] device of the MJU-7 A/B flare).

Because of the low rate of application and dispersal of training chaff fibers and flare residues during defensive training, wildlife and domestic animals would have little opportunity to ingest, inhale, or otherwise come in contact with these residual materials. Although some chemical components of chaff are toxic at high levels, such levels could only be reached through the ingestion of many chaff bundles or billions of chaff fibers. Barrett and MacKay (1972) documented that cattle avoided consuming clumps of chaff in their feed. When calves were fed chaff thoroughly mixed with molasses in their feed, no adverse physiological effects were observed pre- or post-mortem.

Chaff fibers are too large for inhalation, although chaff particles can degrade to small pieces. However, the number of degraded or fragmented particles is insufficient to result in disease (Spargo 1999). Chaff is similar in form and softness to very fine human hair, and is unlikely to cause negative reactions if animals were to inadvertently come in contact with it.

Chaff fibers could accumulate on the ground or in water bodies. Studies have shown that chaff breaks down quickly in humid environments and acidic soil conditions (Air Force 1997). In water, only under very high or low pH could the aluminum in chaff become soluble and toxic (Air Force 1997). Few organisms would be present in water bodies with such extreme pH levels. Given the small amount of diffuse or aggregate chaff material that could possibly reach water bodies, water chemistry would not be expected to be affected. Similarly, the magnesium in flares can be toxic at extremely high levels, a situation that could occur only under repeated and concentrated use in localized areas. Flare ash would disperse over wide areas; thus, no impact is expected from the magnesium in flare ash. The probability of an intact dud flare

leaving an aircraft during training and falling to the ground outside of a military base is estimated to be 0.01 percent (Air Force 2001). Since toxic levels would require several dud flares to fall in one confined water body, no effect of flares on water quality would be expected. Furthermore, uptake by plants would not be expected to occur.

The expected frequency of an S&I device from an MJU-7 A/B or MJU-10/B flare striking an exposed animal depends on the number of flares used and the size and population density of the exposed animals. Calculations of potential strikes to a human-sized animal with a density of 50 animals per square mile, where 8,000 flares were used annually, was one strike in 200 years. An animal 1/100th the size of a human with a density of 500 animals per square mile exposed 100 percent of the time (i.e., animals not protected by burrows or dense vegetation) would also have an expected strike rate of one in 200 years. The S&I device strikes with the force of a medium-sized hailstone. Such a strike to a bird, small mammal, or reptile could produce a mortality. The very small likelihood of such a strike, especially when compared with more immediate threats such as highways, would not be expected to have any effect on populations of small species. Strikes to larger species, such as wild ungulates or farm animals could produce a bruise and a startle reaction. Such a strike from an S&I device would not be expected to seriously injure or otherwise significantly affect natural or domestic species.

Flare debris also includes aluminum-coated mylar wrapping and lighter plastic parts. The plastic parts, such as end caps, are inert and are not expected to be used by or consumed by any species. The aluminum coated wrapping, as it degrades, could produce fibrous materials similar to naturally occurring nesting materials. There is no known case of such materials being used in nest construction. In a study of pack rats (*Neotoma* spp.), a notorious collector of odd materials, no chaff or flare materials were found in nests on military ranges subject to decades of dispensing chaff and flares (Air Force 1997). Although lighter flare debris could be used by species under the airspace, such use would be expected to be infrequent and incidental.

Bovine hardware disease is of concern for domestic cattle. Hardware disease, or traumatic reticuloperitonitis, is a relatively common disease in cattle. The disease results when a cow ingests a foreign object, typically metallic. The object can become lodged in the wall of the stomach and can penetrate into the diaphragm and heart, resulting in pain and infection; in severe cases animals can die without treatment. Treatment consists of antibiotics and/or surgery. Statistics are not readily available, but one study documented that 55-75 percent of cattle slaughtered in the eastern United States (U.S.) had metallic objects in their stomachs, but the objects did not result in damage (Moseley 2003). Dairy cattle are typically more vulnerable to hardware disease due to the confined nature of dairy operations. Many livestock managers rely on magnets inserted into the cow's stomach to prevent and treat hardware disease. The magnet attracts metallic objects, thereby preventing them from traveling to the stomach wall.

The culprit of bovine hardware disease is often a nail or piece of wire greater than 1 inch in length, such as that used to bale hay (Cavedo et al. 2004). If livestock ingested residual materials of the M-206, MJU-7 A/B, and MJU-10/B flares, the plastic materials of the end cap and slider and the flexible aluminum wrapping would be less likely to result in injury than a metallic object.

Flares used for training by F-22 and F-15 aircraft are designed to burn out within approximately 400 feet of the release altitude. Given the minimum allowable release altitudes for flares, this

leaves an extensive safety margin to prevent any burning materials from reaching the ground (Air Force 2001). In the Alaska training airspace, flares must be released above 5,000 feet AGL from June 1 to September 30 to reduce any potential of a flare-caused fire. For the remainder of the year when soils and vegetation are moist or snow covered, flares can be released above 2,000 feet AGL. Plastic and aluminum coated wrapping materials from flares that do reach the ground would be inert. The percentage of flares that malfunction is small (<1 percent probability for all categories of malfunction; Air Force 2001). Dud flares (i.e., those that do not ignite at release and fall intact to the ground) contain magnesium, which is thermally stable and requires a temperature of 1,200 degrees Fahrenheit for ignition. Self-ignition is highly unlikely under natural conditions.

F4 References

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Acronyms

µg	Microgram	CIAS	Knots Indicated Airspeed
3 WG	3 rd Wing	L _{dn}	Day-Night Average Sound Level
AATA	Anchorage Alaska Terminal Area	L _{dnmr}	Onset-Rate Adjusted Monthly Day-Night Average Sound Level
ACHP	Advisory Council on Historic Preservation	L _{max}	Maximum Sound Level
ADEC	Alaska Department of Environmental Conservation	LR5OW	Long Range Standoff Weapons
AFB	Air Force Base	m ³	Cubic meter
AFI	Air Force Instruction	MBTA	Migratory Bird Treaty Act
AFOSH	Air Force Occupational Safety and Health	MFE	Major Flying Exercises
AGL	Above Ground Level	MMPA	Marine Mammal Protection Act
AIRFA	American Indian Religious Freedom Act	MMT	Million Metric Tons
AK SCC	Alaska Species of Special Concern	MOA	Military Operations Areas
APZ	Accident Potential Zones	MR_NMAP	MOA-Range NOISEMAP
AQCR	Air Quality Control Regions	MSL	Mean Sea Level
AR	Aerial Refueling Tracks	MTR	Military Training Routes
ARTCC	Air Route Traffic Control Center	NAAQS	National Ambient Air Quality Standards
ATC	Air Traffic Control	NEPA	National Environmental Policy Act
ATCAA	Air Traffic Control Assigned Airspace	NHPA	National Historic Preservation Act
BASH	Bird-Aircraft Strike Hazard	NIOSH	National Institute of Occupational Safety and Health
BLM	Bureau of Land Management	NM	Nautical Miles
BRAC	Base Realignment and Closure	NMFS	National Marine Fisheries Service
CAA	Clean Air Act	NO ₂	Nitrogen Dioxide
CDNL	C-weighted Day-Night Average Noise Level	NOI	Notice of Intent
CEQ	Council on Environmental Quality	NRHP	National Register of Historic Places
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act	NRIS	National Register Information System
CFR	Code of Federal Regulations	O ₃	Ozone
CIBW	Cook Inlet beluga whale	OSHA	Occupational Safety and Health Administration
CO	Carbon Monoxide	Pb	Lead
CO _{2e}	Carbon Dioxide Equivalent	PM ₁₀	Less Than or Equal to 10 Micrometers in Diameter
CZ	Clear Zones	PM _{2.5}	Particulate Matter less than 2.5 microns in diameter
dB	Decibel	PPM	Parts per million
DoD	Department of Defense	PSD	Prevention of Significant Deterioration
EA	Environmental Assessment	PSF	Sonic Boom Peak Overpressures
EIAP	Environmental Impact Analysis Process	PTE	Potential to Emit
EIS	Environmental Impact Statement	R-	Restricted Areas
EO	Executive Order	ROD	Record of Decision
EOD	Explosive Ordnance Disposal	ROI	Region of Influence
ERP	Environmental Restoration Program	S & I	Safety and Initiation
ESA	Endangered Species Act	SDB	Small Diameter Bomb
FAA	Federal Aviation Administration	SEL	Sound Exposure Level
FHWA	Federal Highway Administration	SHPO	State Historic Preservation Officer
FONSI	Finding of No Significant Impact	SIP	State Implementation Plan
FTE	Fighter Town East	SO ₂	Sulfur Dioxide
FY	Fiscal Year	SPL	Sound Pressure Level
GBU	Guided Bomb Unit	SUA	Special Use Airspace
GHG	Greenhouse Gases	TPY	Tons Per Year
GWP	Global Warming Potential	U.S.	United States
HAZMART	Hazardous Materials Pharmacy	USACE	U.S. Army Corps of Engineers
Hz	Hertz	USAF	United States Air Force
IFR	Instrument Flight Rule	USC	United States Code
IICEP	Interagency and Intergovernmental Coordination for Environmental Planning	USEPA	United States Environmental Protection Agency
IR	Instrument Route	USFWS	U.S. Fish and Wildlife Service
JBER	Joint Base Elmendorf-Richardson	VFR	Visual Flight Rule
JDAM	Joint Direct Attack Munition	VR	Visual Route
JPARC	Joint Pacific Alaska Range Complex		
kHz	Kilohertz		